SCIENTIFIC AMERICAN

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A NOVELTY IN BOLT CUTTERS.

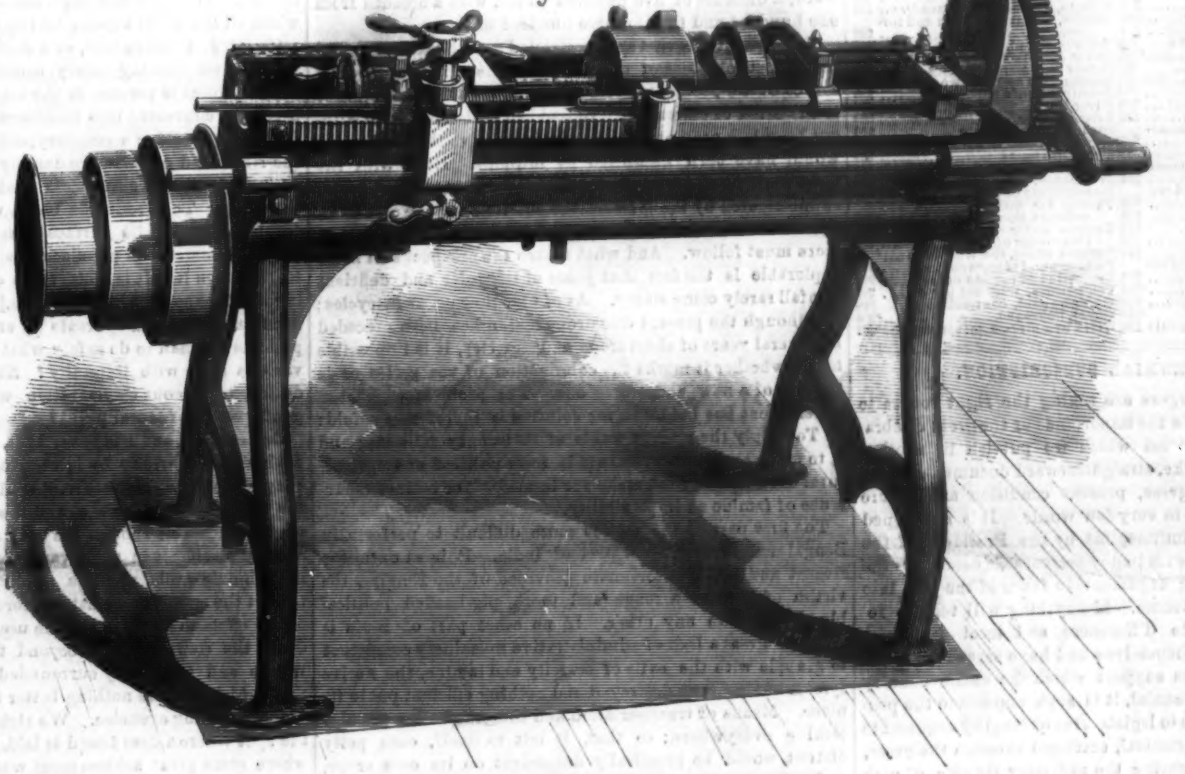
All machinists are aware that, in making bolts which require the face o. the head or nut to be at exact right angles to the axial line, to insure accurate fits on finished work, it has been necessary to chase the threads on a screw-cutting lathe. To this operation there are many objections, among which may be noted the requirement of skilled workmen to grind properly and to set the tool, and also to watch the work, in order to obtain uniformity in size, through constant tests of each piece, as the chasing tool makes its last cut. With all these precautions, however, it is almost impossible to thread any number of bolts, in a screw-cutting lathe, to exactly the same diameter; variations of size occur, to the detriment of accurate fitting, so that, in fine, the process is comparatively imperfect and slow, and, as a consequence, far from economical.

With the above facts in view, Mr. Aurin Wood, of Worcester, Mass., has recently applied, to a bolt-threading machine, centers for holding the work exactly as it is secured in lathes, so that the finished bolts, while retained with the same axial accuracy as in the last mentioned machines, may be threaded by the dies with the certainty of the line of the thread having correct relation to the axial line of the piece. By combining this improvement with a bolt cutter of his own invention, Mr. Wood has produced the apparatus represented in our engravings, which, we are informed, has proved, in every particular, a complete success.

The reader conversant with this class of tool will require no explanation to aid him in perceiving the general arrangement and relation of the actuating mechanism; so that without considering details in this particular, we may at once pass to the notice of the important improvement above suggested. Fig. 1 affords a perspective view of the machine, and in Fig. 2 the same is shown tilted, to exhibit more clearly the essential portions. A is the die holder, which supports the dies for threading the bolt in the usual manner. The bearing, B, which is caused to revolve by proper mechanism, carries the head, through which passes longitudinally a mandrel, C, moving freely back and forth. D is the carriage which holds the bolt to be threaded, and which is so actuated as to slide to and from the cutting head. Parallel to the axis of the latter is a bar, E, which moves longitudinally in the supports shown. This bar is connected to the mandrel, C, and also to the carriage, D, by arms, so that, when the carriage travels toward the head, the mandrel will be correspondingly moved and *vice versa*. The mandrel has a center or point, F, which is the actual center of revolution of the head; and a corresponding point is arranged in the carriage, both centers being in axial line with the cutting dies of the head. The center to the carriage is made adjustable by means of the screw, G.

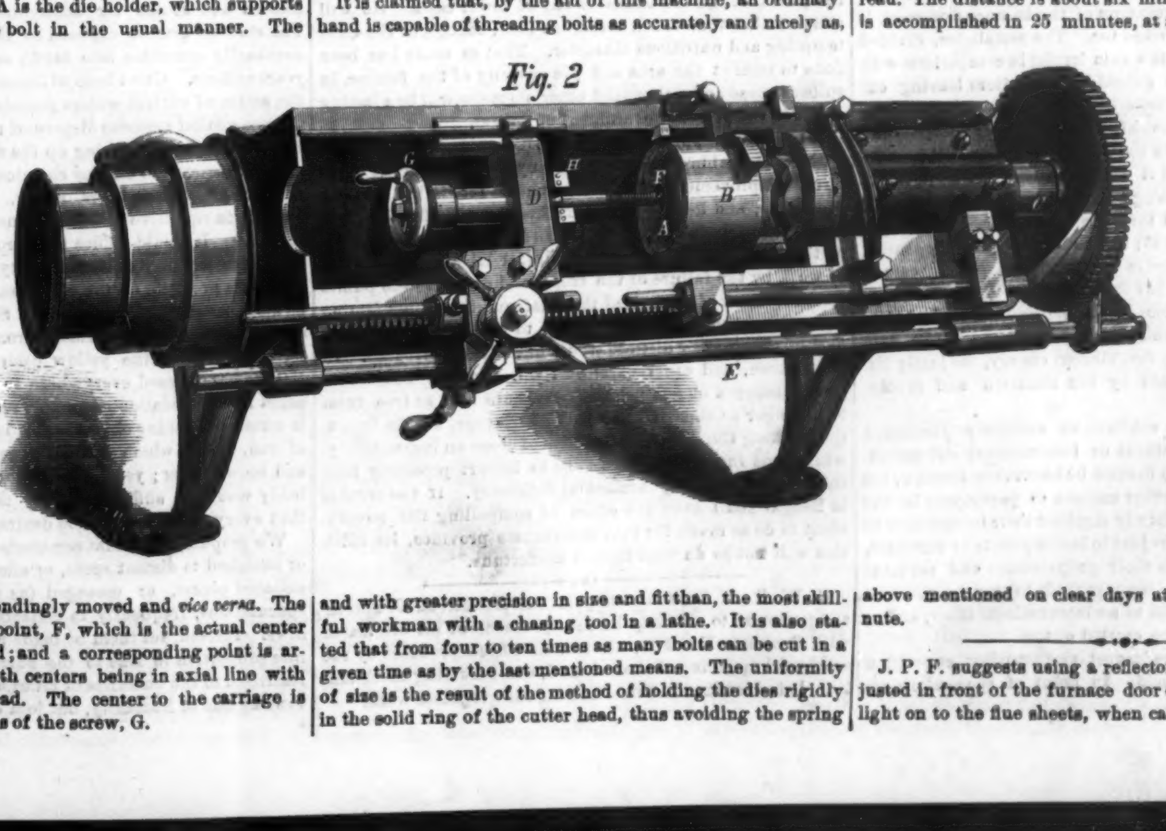
The bolt to be threaded is first centered and turned in the usual manner, as if to be cut in a screw-cutting lathe. It is then placed on the centers of the machine and secured so as to be run into the dies, guided only by the longitudinal movement of the movable center, F, and the carriage, D. For different lengths of bolts, the arm, in connection with the carriage, is disengaged from the bar, E, and the carriage is moved to the desired relative position and again secured. In order to prevent the work from turning, an ingenious device is provided in the forward end of the carriage, at H. The bolt is arranged upon the centers between the roughened faces of two cams, which, when two slides are adjusted relatively to the diameter of the piece, bear firmly against it. The tendency of the bolt to rotate with the cutting device causes, by contact, a corresponding motion of the arms, which finally, by their shape, offer a rigid resistance, and thus firmly hold the work. For considerable difference of diameters, a suitable bolt, joining the sides, allows of their proper adjustment, but ordinarily the apparatus forms a self-adjusting dog.

Fig. 1.



WOOD'S IMPROVED BOLT CUTTER.

Fig. 2



It is claimed that, by the aid of this machine, an ordinary hand is capable of threading bolts as accurately and nicely as, and with greater precision in size and fit than, the most skillful workman with a chasing tool in a lathe. It is also stated that from four to ten times as many bolts can be cut in a given time as by the last mentioned means. The uniformity of size is the result of the method of holding the dies rigidly in the solid ring of the cutter head, thus avoiding the spring or variation often noticeable in machines in which the set of the dies is given by levers or other devices, uncertain in positive results.

Another feature of merit in this machine is the automatic arrangement by which the dies, after being set to the desired length of thread, are instantly opened at that point, and the bolt carrier thrown back to receive a new bolt. This arrangement, besides insuring uniform length of cut, avoids the danger of accident or breakage owing to running the holder against the dies, through inadvertence or inattention of the workman. One operator, through this device, readily keeps two or more machines continually at work.

This improvement, of adding centers, for the axial holding of bolts, to bolt threading machine, which we have now fully described, was patented in the United States by Mr. Wood, February 10, 1874, and similar protection has also been obtained in Canada and several European countries. These machines, as at first patented in July, 1868, without the centers, were exhibited at the American Institute Fair of 1869, and there, we are informed, gained a gold medal over several competing machines. They have since been successfully introduced in many prominent locomotive and railroad shops throughout this country and Canada. These machines are made in three different sizes, ranging in cut from 5-16 inch to 2½ inches; and, with or without the new improvement, are manufactured by the Wood and Light Machine Company, of Worcester, Mass., to whom inquiries for further information may be addressed.

Practical Use of Velocipedes.

The bicycle, after going entirely out of fashion as a toy, is now being put to some practical use. Messengers, called "velocemen," thus mounted, convey dispatches in Paris from the Bourse—or stock exchange—to the central telegraph bureau. The distance is about six miles, going and coming, and is accomplished in 25 minutes, at a charge of 50 cents. A company is being formed to place a very large number of velocipedes upon the streets and to supply messengers to go to any part of the city. The Parisian journals are also using the bicycle to obtain quick reports. During the trial of Marshal Bazaine, the *Moniteur* employed daily a large number of vehicles, running from the palace of Versailles to Paris. The distance, about 13 miles, was made in 45 minutes, and quicker than the ordinary trains on the railroad. Carrier pigeons were also used by the papers, the birds easily traversing the distance above mentioned on clear days at the rate of a mile a minute.

J. P. F. suggests using a reflector (a tin plate will do), adjusted in front of the furnace door of a boiler, so as to throw light on to the flue sheets, when caulking leaks.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE CENTENNIAL SUBSCRIPTION.

The centennial managers are taking the right course to impress upon the people the importance of the great celebration of 1876. The address which we publish in another column is a business-like, straightforward document, which sums up the past progress, present condition and future needs of the enterprise in very few words. It is not signed by an impersonal committee, but by the President of the Board of Finance; and with happy terseness,it condenses the gist of the most telling arguments in favor of the plan into the fewest possible sentences. If anything will tend to reconcile the unfortunate differences and local jealousies which have presented themselves and have served to interfere with the unanimous support which the entire country should give to the Centennial, it is such appeals to the people as this. Memorials to legislatures or lengthy arguments more theoretical than practical, scattered through the press, are of little avail in securing the necessary returns of cash which are needed, not at some future and indefinite period, but now, in order to ensure the success of the scheme. The people, are told, plainly and succinctly, that if the United States is to commemorate its hundredth birthday by a grand celebration which will worthily testify its unexampled progress, it must not be left to politicians to dole out such appropriations as will make up the requisite number of millions, but that individuals must personally open their pocket books and buy the shares. Ten millions of dollars is the total amount needed; of this, four millions have been subscribed, and a good percentage of the balance Congress, it may be expected, will provide for. The remainder, divided throughout the country, is a sum trivial in comparison with merely the benefits to be gained by exhibitors leaving out patriotic considerations altogether.

There are scores of manufacturers who intend, beyond doubt, to be represented in the Centennial, who will partake largely of the advantages it offers and who are abundantly able to take up the remaining shares of stock without feeling the outlay. It is time that the jealous feeling against Philadelphia should die out; in this city it has disappeared, and there is an earnest desire for the unequivocal success of the work. Philadelphia has fully made good her claims to be the site of the exposition, by the subscription of $4,000,000, tenfold her quota and nearly half of the entire sum needed, supplementing,by magnificent energy, the justly important advantages offered by her situation and revolutionary associations.

It is too late also to continue an unseemly dissension over the question of a national or international exposition. By its official acts, which cannot be honorably recalled, the government has invited other nations to participate in our festival,and many have already signified their intention of so doing. It would hardly be just to invite guests to our feast, and, after they have begun their preparations and set aside money for their coming, to request them to stay away. The Centennial was inaugurated as an international affair, and as such, we think, it should be carried out.

It is moreover to be the largest and grandest exposition that the world has yet beheld. In point of space alone, its buildings are to cover 3,000,000 yards, against 2,530,400 and 481,500 square yards filled by the Vienna and Paris fairs. The time remaining is but two years, and the greatest activity will be necessary to complete preparations during that period. It is for this reason that the appeals now before the people are doubly urgent. We trust that the response will be both speedy and adequate.

THE FAMINE IN BENGAL.

Accustomed only to unbroken plenty,it is happily impossible for American minds to form any adequate conception of a state of things like that now prevailing in Lower Bengal. The haziness of our knowledge of Indian geography helps still more to lessen the effect of the pictures of human wretchedness outlined in the cable reports. We are incapable both of estimating the extent of the troubles there, and of supplying from our own experience the unreported details. Benares, Patna, Baugulpore, Rajshaye, Burdwan—what are they but heathenish names, standing for we know not what? Even when we translate them into familiar terms, and find that they represent a territory greater by a third than all New England, packed with a population equal to that of the United States and British America combined, the appalling fact that its swarming millions are pressed by want, if not face to face with starvation, loses most of its significance through our ignorance of what famine really means.

As mapped by Sir Bartle Frere, the stricken district is shaped somewhat like a clumsy boot with a thick foot and an expanded top—the toe resting on the Hooghly,the heel on the Brahmapootra three hundred miles away to the north,the leg covering the broad valley of the Ganges to the westward, a distance of five hundred miles, with a breadth from one hundred and fifty to three hundred miles.

Throughout this vast area,protracted drouth last fall caused the almost total loss of the rice crop, the principal food resource of the people, who have been brought in consequence to the brink of starvation. Indeed had assistance from without been less prompt or less generous, the victims of famine would have been numbered by millions. Even with the most untiring and liberal efforts of the government of India, supplemented by the gifts of the charitable the world over, deaths from starvation have already been numerous, and more must follow. And what makes the prospect still more deplorable is the fact, that years of irregular and deficient rainfall rarely come singly. As of old, they occur in cycles; and though the present disastrous season has been preceded by several years of short crops and scarcity, it is impossible to say whether it marks the culmination of the series or is the first of a new and worse one. The problem which the government has before it for solution is therefore twofold: 1. To supply the present wants of its hungry millions; and 2, to make such improvements in their political and agricultural condition as shall make the immediate or remote recurrence of famine an impossibility.

The first part of the task is more difficult to perform in Bengal than in any other part of India. It is at once the richest and most unfortunate province of the Empire, the victim of greater wrongs and more pig-headed political blundering than any other. In no other part of India is there so great a lack of administrative machinery competent to grapple with the evils of scarcity and famine, the native system having been destroyed and nothing efficient put in its place. Means of transportation and communication are also lacking everywhere; so that, if left to itself, each petty district would be practically dependent on its own crops, and millions might starve while there was plenty all around, for the simple reason that food could not be brought to them. To provide for the distribution, at the right time and in the right places, of the thousands of tuns of food, which the government has thrown into the suffering districts, has been and must be the most difficult portion of its gigantic charity.

The distribution of food is made still more difficult by the system of caste, stronger in rural Bengal than in any other part of India. The ordinary Hindoo is not only restricted to a very limited range of vegetable diet, but even that must not pass through the hands of one of lower caste. He will starve rather than touch forbidden food, though of the most tempting and nutritious character. That so much has been done to restrict the area and the severity of the famine, in spite of these and a thousand other obstacles,will be a lasting credit to the present government of Bengal.

It has also grappled with the second part of the problem with considerable earnestness. Many extensive works of internal improvement—railroads, canals for irrigation and commerce, and local roads which had been suffered to languish through false economy—are being pushed to completion by the thousands of agricultural laborers thrown out of work by the failure of the crops, and driven to the public works by need of food. Had these safeguards against famine been completed in time, it is safe to say that the greater part of the existing distress would have been prevented. In the Deccan, and other parts of India formerly subject to fearful seasons of famine, the people are now as free from that danger as those of any part of Europe, ample irrigation making the general destruction of crops an impossibility, while good roads make it possible to import promptly food enough to supply any accidental deficiency. If the trouble in Bengal shall have the effect of compelling the government to do as much for that unfortunate province, its affliction will not be an unmitigated misfortune.

G. W. P., M. D., writes to point out that Mr. R. B. Forbes' suggestion as to calming the sea by means of oil originated with Benjamin Franklin, who saw the effects produced by the accidental upsetting of a barrel of oil, while crossing the Atlantic. It is described in Franklin's autobiographical work.

EREMACAUSIS VERSUS BURIAL AND CREMATION.

BY PROFESSOR ALBERT R. LEEDS.

Is there no other alternative in the disposal of the dead than our present practice of inhumation and the proposed cremation? The shortcomings of the former,and the long catalogue of hurtful consequences, are conceded; but are the superior advantages of cremation established? Passing by the social, æsthetic, and religious considerations involved, can the advantages which are claimed for cremation, by those who profess to advocate it on scientific grounds, be regarded as proven? Is the immediate conversion of the highly organized and nitrogenized tissues of the body into certain gases and water, the most economical method of returning to the earth the forces and substances needed for its fertilization? No: on the contrary, cremation would proceed in direct violation of well ascertained principles in the use and economy of natural forces; for all the power exerted by the burning fuel, to break up the animal tissues into carbonic acid and water, would have to be put forth again in order to recombine them into those compounds of carbon, hydrogen, and oxygen, which make up the cells and fibers of animals and plants. Nature, which has the vastly greater burden of disposing of all animals other than man, rarely resorts to the wasteful expedient of burning them by rapid combustion. She effects this end by slow combustion, or, as Liebig termed it, eremacausis.

It would be well, then, before resorting to artificial devices and patenting improved forms of furnaces for most rapidly getting rid of the dead body, as it is feelingly called, that we should turn to Nature and take from her a few preliminary lessons. We shall find that she seldom applies the torch, while all the while accomplishing her end. There is not a rotting log, a fallen leaf, or a dead insect, worm, or animal, which is not burning slowly, combining insensibly with the oxygen which is present in the air or dissolved in water,and becoming converted into fertilizers. Regarded in this aspect the whole world is a cemetery,and the tropical forests along the Niger and Amazon are densely populated ones. Yet we do not find that pestilences make life impossible to the survivors. The ground is black with organic remains, and furnishes beneath its surface such stores of food that it supports a subterranean population, almost as vast as that which teems above it. It is a magazine of vegetative power, sending up all shapes of luxuriant life,just such a soil as the husbandman endeavors to create by artificial means. Is it not possible for man to do safely what Nature does on so much vaster a scale with impunity? Should he be compelled to destroy in hideous conflagration what Nature consumes so gently on her funeral pyres?

Our error is, and has been, that, in this as in other cases, we have done wrong by interfering with or only partially obeying the laws of Nature. While professing a belief in the immortality of the soul and the perishability of the body, we have acted as though the body should be immortalized; and, by placing it in stone vaults of Cyclopean masonry or in non-oxidizable metallic envelopes, have endeavored to thwart the operation of natural forces and prevent the return of the effete to the realm of the useful. In the burial of the dead, the coffin is sunk beyond the reach of infiltrating waters and frequently surrounded with impermeable clay, than which there is nothing better to exclude the operation of decomposing agencies. We rightly view with reverence the spot where a dear friend is laid, just as we do the ground where some great achievement was wrought, although we know that every vestige of his body has perished. Why then attempt to prolong by a few years the pitiful remains? This idea has had but the effect of populating the ground, and rendering it necessary finally to desert it, and seek some new cemetery. Instead of so doing, make the spot for ever hallowed, and let our cemeteries remain, while permitting Nature, untrammeled or assisted by means which she herself teaches, to dispose of the bodies.

This is not an empty suggestion. Chemistry points out to us what must take place, and suggests a variety of substances and means for accomplishing the desired result. The stoutest granite exposed to the action of air and rain eventually crumbles into sand; and for most rocks, a few years suffices. Great beds of limestone may be dissolved by the action of surface waters percolating through the ground. Cannot similar agencies dispose of the few pounds, mostly of carbonate of lime, making up the animal skeleton? It would not be necessary to employ chemicals having a violent caustic action, like lime or acids, which, in consequence, suggest operations repulsive to our sentiments of tender respect for the dead. It would suffice to surround the body with some substance which would carry oxygen to the tissues, and allow the products of the slow combustion thus effected to be distributed through the soil. Such a substance, for example, is the hydrated oxide of iron. This is the same material that gives the yellow color to the soil, and which Nature has diffused everywhere to sweeten the ground and assist in the oxidation of organic remains buried in it. There is certainly nothing objectionable in the appearance of oxide of iron, a body which forms the coloring matter of yellow and brown ocher; yet, as Professor Wurtz suggested, it probably would be sufficient to lay the body in this, in order that every vestige should be destroyed in a few years.

We propose, then, that cemeteries should not be transient, or banished to distant spots, or allowed to be located in unsuitable places, or managed (as at present) as successful speculations, frequently in defiance of well known sanitary laws. Instead, let them be made permanent, bearing a definite proportion in size to the surrounding population: not restricted to the outskirts of cities,and swept away by the advancing tide of humanity, but located upon sites well adapted

for them, whether in the midst of cities or in suburbs. Let the ground grow more sacred as the spot where were placed not one but many generations of those connected with us by the ties of filial love, and more beautiful by accumulated treasures of art erected as memorials of the unnumbered dead who have temporarily reposed there. We believe that some method similar to that which has been advocated above, and which is, to the best of our knowledge, brought forward for the first time in this place, is not open to the objections which are justly urged against our present methods of inhumation: that it is in accordance with the latest teachings of Science in this direction, and that it will serve to increase and not diminish the tender love and reverence for the dead, which has steadily grown with all that is most excellent and beautiful in poetry and religion.

THE EFFECTIVE POWER OF TURBINE WATER WHEELS.

The failure of turbine water wheels to supply the amount of power expected is not less common than that of steam engines, and the causes are more numerous. Before purchasing turbines, it is necessary to ascertain the head of water available, and that there is an abundant supply; after which large allowance should be made for the friction of shafting, as well as for the power necessary to drive the special machinery, and the whole determined in horse power. The selection of a wheel then becomes necessary. There are legions of makers, each of which is ready to warrant his to be the best wheel made. All of them publish artistic tables of sizes and powers, always guaranteed reliable. The uninitiated purchaser usually procures many of these tables, having voluminous descriptions and letters of commendation attached; and on examining them, he is surprised at the elaborate displays of figures, and often loses himself in contemplating the accuracy of the decimals. When comparing the tables of the various makers, he wonders why there is such uniformity of high powers in wheels so different. In studying the details, he finds that Smith's Excelsior Concave Fluted Turbine of forty-eight inches diameter will give him 84·71 horse power; while Jones' Scroll Flanged Buggy Wheel of the same diameter is fully warranted to yield 85·97, that being a gain in favor of Jones of 1·26 horse power, besides the further advantage of running with or against the sun, as desired. In continuing his comparisons to other wheels, it is needless to say that he becomes bewildered among so many wheels so far excelling each other, and finds himself unable to decide which wheel is the best. He is forced to seek the advice of some competent engineer, and, to his utter astonishment, learns that the figures of the tables so nicely prepared are in almost all cases totally unreliable, there being scarcely a maker's wheel that, in a test flume, under the most favorable circumstances, ever for a single hour indicated the the power claimed, and almost none that in actual use approach the figures, many of them scarcely yielding half what is claimed. Under these circumstances, it becomes important, in selecting a good wheel, to be assured that it will furnish ample power. After ascertaining a reliable maker, in order to determine the exact size of the wheel it is necessary that at least one third should be allowed for variations in water levels, and for the loss consequent to the wear of wheels and gates; and, in addition, figures should be made, based on but a little more than a half gate of water to the wheel. The best wheels afford almost all of their power at a five eighths gate or under, and a difference between a half and full gate is not more than should be the margin necessary to regulate speed. In use it will be found that opening gates seven eighths or fully simply amounts to a large consumption of water, generally without producing five or ten per cent additional power. Some good wheels give less power when at full than at part gates. The rule should be to buy a wheel amply sufficient at about half gate, due allowance being also made for over estimate of power. We think the experience of all who have placed wheels with a less liberal allowance will bear out and confirm this rule. Allowing one fourth for the friction of the shafting of a cotton or woolen mill, without adding one third more for a reserve when in actual use, will scarcely fail to cause a manufacturer to wish that he had bought a larger wheel. Actual tests, accurately conducted, of thirty-one styles of turbines show the comparative range of effective force, under the best possible advantages, to be as follows: At quarter gate, from 13 to 50 per cent; half gate, from 11 to 71 per cent; three quarter gate, from 31 to 83 per cent, and at full gate, from 53 to 84 per cent, the best wheels giving out about all of their power at from five eighths to three quarters openings; while the lower classes give but little power unless flooded with water, and even then fall far short of the amount claimed for them. Another reason why large wheels should be used is that, almost universally, high and low points of the head and tail waters so reduce the force of wheels as to cause partial stoppages of machinery, unless there is surplus power when the water is at the ordinary stage. We are acquainted with a mill using ten independent turbines of various styles. Experience has here shown practically that the relative power of the wheels, to that necessary to drive the machinery under constantly occurring unavoidable disadvantages, has not been unduly stated, and that not meager allowances should be made as reductions from makers' over-estimates of the powers of their wheels, as well as farther liberal allowances for the friction of the shafting, loss of power in times of high and low water, and the margin necessary for the action of the governors. It has also been found true here that substituting large wheels, operating at from one fourth to one half gate, for small wheels, requiring seven eighth gates, results in the use of much less water for a given effect. Were wheels accurately tested in places of use, and actual power ascertained, such large fractions of allowances would not be necessary; and a less rate of proportion between that wanted and that claimed by makers is accordingly found satisfactory with wheels where such claims are based upon tests. It will always be found to be by far the most economical, with both steam and water, to provide abundance of motive power.

ARMY ANTS.

It is a suggestive circumstance that, among the many varieties of animal forms, those which approach man most nearly in social and mental development are not his nearest allies, but creatures of an entirely different order, and those which stand at the head of their class, the articulates, as man does at the head of the vertebrates.

The closeness of formic mimicry of human civilizations is all the more surprising when we take into account the vast difference between the physical conditions of the two types of life. With nothing apparently in common, not even similarity of structure, men and ants have fallen into lines of development so nearly parallel in many instances as to suggest the existence of something far more imperative in the tendencies of life, and at the same time a much greater limitation in the possibilities of development, than are commonly suspected. Especially to those who regard mind as an unmixed product of material conditions, and would measure mental power by weight of brain, nothing can be more perplexing than to see the almost microscopic cerebral ganglia of the ant evolving products so like those of the immensely more bulky brain of man that their practical identity is unquestionable.

But our purpose is not to study the mystery of formic intelligence in general, but the peculiar manifestations of it by certain species whose modes of life have been recently investigated.

As a general thing, ants are found in settled communities, which change their habitations rarely, and then for causes not under their control. A remarkable exception to this rule is found in the *ecitons*, or army ants of Central America. These, while existing in thoroughly organized communities, numbering myriads if not millions, never make permanent settlements, but are constantly roaming about the forests in vast multitudes, scourging the insect world as the migrating armies of Attila scourged the less warlike nations of Europe.

The traveler's attention is usually called to one of these predatory swarms by the twittering of birds which follow their course to feast on the flying insects which they scare up. Approaching, he will discover a dense body of ants, in a column three or four yards wide and of enormous length, moving rapidly and examining every nook and corner where their game may hide. The captured insects are speedily torn to pieces and carried to the rear, or to their temporary camp, by relays of workers. On the flanks and in advance of the main army, smaller columns of skirmishers are thrown out to flush the insects they are in pursuit of, many of which, in their terror, bound right into the midst of the main column, to be torn to pieces instantly. The greatest catches occur in masses of brushwood. Here the cockroaches, grasshoppers, spiders and other insects take refuge among the branches, while the ants are occupying the ground below. But their security is brief. In a little while explorers are sent up, following every branch and driving the refugees to the ends of the twigs, to fly into the air and be snapped up by the birds, or drop among the throng of ants below. In this dilemma the spiders alone have any means of escape; they can suspend themselves in mid-air and remain in safety until their enemies have retired from the bushes and passed on to other conquests.

The individuals of this species of ants (*eciton predator*) are of various sizes, the largest being about a quarter of an inch long, the smallest less than an eighth of an inch. A much larger variety (*eciton hamata*) pursue their prey in a similar manner, but vary their tactics somewhat as occasion demands. When on a general hunt, they spread their columns over a considerable breadth and sweep everything before them, crickets, grasshoppers, scorpions, centipedes, woodlice, cockroaches, and spiders falling almost certain prey. Exploring parties are also sent up trees to look for nests of bees, wasps, and probably birds. The moment a prize is found the fact is reported to the army below, and a column is sent up to take possession. Mr. Belt, to whom we are indebted for these observations, and whose "Naturalist in Nicaragua" gives more numerous and valuable additions to the science of natural history than any book of travel since Wallace published the "Malay Archipelago," describes these ants as pulling out the larvæ and pupæ from the cells of a large wasp's nest, while the owners were hovering about, powerless, from the multitude of their invaders, to render any protection to their young.

When hunting in solid columns, these ecitons were found to be generally, if not always, in search of the young of another species of ants (*hypoclinea*) which make their nests in fallen timber. When a log is found, the column spreads out over it, searching all the holes and cracks, the smallest individuals pursuing the unfortunate hypoclineas to the furthest ramifications of their nests. The invaded ants rush out bearing their young in their jaws, and are despoiled of them so quickly that it is quite impossible to see how it is done. The ecitons do not harm the mature hypoclineas, caring only for the larvæ and pupæ, which are hastily borne to the rear of their column. What they do with their plunder finally does not appear. It would seem that they cannot rear the young hypoclineas for slaves, as certain northern ants do with their prey, since no mention is made of any such addition to the membership of their communities.

When marching, these eciton armies appear to be directed by numbers of individuals, of a larger size and a lighter color than the regular workers, scattered at intervals of two or three yards. They stop often, and occasionally run back a little and touch some of the other ants with their antennæ, as though giving orders. At the headquarters there are individuals of still greater size and more ferocious aspect, which soon make any one molesting the nest acquainted with the efficiency of their enormous jaws. The temporary resting places of these ants are usually in hollow trees or underneath large fallen trunks that offer suitable hollows. One which Mr. Belt found in a hollow log, open at the side, must have contained a cubic yard of ants clustered in a dense mass, like a swarm of bees. And these were but a part of the whole community, as many columns were outside, some bringing in the pupæ of other ants, others the legs and dissected bodies of insects captured on their foray. These incomers proceeded directly into the interior of the living mass through tubular passages, which were kept open just as though it were formed of inorganic materials. Like the hunting races of mankind, these predatory swarms are compelled to make frequent removals to new hunting grounds. The migratory columns are easily known by all the common workers moving in one direction, the larvæ and pupæ of the community being carefully carried in their jaws.

Many observations and experiments were made by Mr. Belt, testing the individual intelligence of these wonderful creatures. Though inferior in some respects to ants which hunt singly, he does not hesitate to place them at the head of their order for intellectual and social development.

SCIENTIFIC AND PRACTICAL INFORMATION.

STEAM LIFE BOATS.

Mr. H. G. A. Mitzlaff, in a paper read before the Institute of Naval Architects, proposes the use of steam in life boats, and suggests the hydraulic propeller or rotary pump as best adapted for propulsion. He proposes the following dimensions for such boats: Length 45 feet, breadth 11 feet, draft 3 feet. The boat is provided with airtight chambers to prevent sinking.

THE HEAT OF THE SUN.

Father Secchi, the distinguished Italian astronomer, has recently published the result of his investigations in the solar temperature, made during last summer, and states that his efforts were directed toward the determination of the relation of the solar radiation with that of the electric light. The instrument used was a thermo heliometer of the investigator's own invention, and the conclusion reached was that the radiation of the sun would be 36¼ times that of the carbon points. If, therefore, the temperature at the surface of the latter is fixed at 5,432° Fah., a number not exaggerated, and supposing the radiation proportional to the temperature, we obtain for the potential temperature of the sun 240 836° Fah.

ELECTRICAL FIGURES UPON CONDUCTORS.

M. Schneebeli has investigated the conditions on which depend the dimensions of Kundt's electrical figures, which result from the adherence of a fine isolating powder on a metallic conductor, from which a discharge is emitted. In the experiments, the discharge of a Leyden jar took place between a horizontal metallic plate sprinkled with lycopodium and an electrode in the form of a ball or cone above the plate. It was found that, the circumstances being equal, the diameter of the figure augmented with the distance from the electrode to the plate, but never in a constant ratio. The size of the figure augments also with the quantity of electricity which produces it. When the electrode is composed of a certain number of points, a regular circular figure is formed beneath each one. If in the path of the discharge a small plate of glass be introduced, a space clear of powder appears on the metal plate of exactly the form of the glass plate interposed. With electrodes of conical form, presenting an angle of 60° or 30°, it is stated that the electrical figure is larger as the angle at the summit of the cone is smaller. Finally, the diameter of the electrical figure is larger when the discharge takes place in a rarefied gas than at normal atmospheric pressure.

JAPANESE BRONZE.

A curious bronze is produced in Japan, which, when made in thin plates, resembles slate, and is covered with designs in silver. M. Morin has lately analyzed and examined the properties of the alloy, and finds that it contains, in addition to copper, from 4 to 5 per cent of tin, and on an average 10 per cent of lead. The combination is easily molded into thin plates. These are varnished, and through the covering the designs are scratched with a burin. The plate is then plunged in a silver bath, when the silver is deposited on the unprotected portions. Lastly, it is placed in a muffle furnace, when the copper blackens and the silver remains bright.

CURIOUS PHENOMENON OF ENDOSMOSIS.

If the membrane which lines the interior of an egg shell be used to close the tube of an endosmometer, the latter being filled with sugar and water, and its containing vase with pure water, an odd circumstance will be noted. If the external surface of the membrane is toward the pure water, endosmosis is very rapid, and the water rises at the rate of some 4 inches per hour. But if, on the contrary, the interior surface is turned to the water, the phenomenon is almost annihilated. Matteuci, it appears, has noticed a somewhat similar peculiarity in the skin of a frog. It would seem that the phenomenon is worthy of study, since it shows that a liquid does not traverse the interior of a cellule with the same facility outwards in as in the contrary direction.

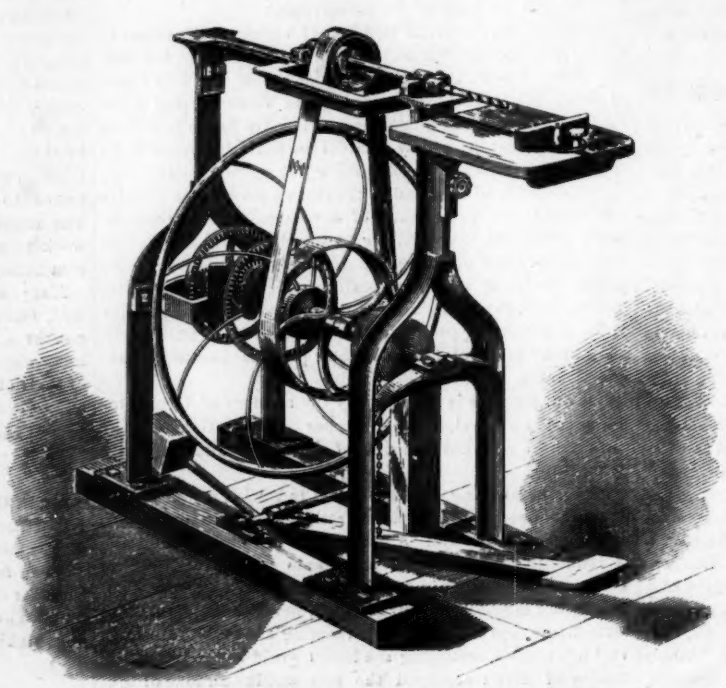
THE VERTICAL MULTIPLIER BORING MACHINE.

We have already laid before our readers three applications of that ingenious combination of gearing, the vertical multiplier, to woodworking machinery. By its use the band saw, the jig saw, and the circular saw have been adapted to run by the foot power of the operator, thus enabling the mechanic whose shop is not of sufficient extent to require the work of a steam engine to supply its place, on the machines most employed, by a device which affords a means of applying his available force at perhaps the best advantage.

We now present, in the annexed engraving, a representation of still another adaptation of the invention, recently made to the boring machine. The nature of the peculiar mechanism through which the power is communicated has already been fully described and explained in other connections, so that no further allusion to its construction is necessary. By its aid, however, in the present machine, forty revolutions of the shaft, actuated by the treadle, correspond to 1,640 revolutions of the bit, a four inch pulley being connected with the latter, making a proportion of one to forty-one. The general arrangement of the boring mechanism will be readily understood from the engraving. A table is provided which, by a slotted support through which passes a set screw, may be adjusted at a hight suitable to the dimensions of the work to be operated upon. It has a longitudinal slot on its surface, in which travels a guide piece, against which the wood to be bored is held by the hand of the operator, as it is advanced toward the tool. This guide piece, by means of a slotted semicircular bar and set screw, may be placed at any desired angle so as to allow for the boring of inclined holes.

We recently had occasion to examine this machine, and found that the tool penetrated through knots or woods in any direction, with much facility and with the exercise of a quite small amount of effort on the part of the operator. It is evident that any sized bit, which can be adjusted to the shaft, may be used. This device will doubtless prove a useful addition to the shops of wood workers generally.

For further information, address the Combined Power Company, 23 Dey street, New York city.



VERTICAL MULTIPLIER BORING MACHINE.

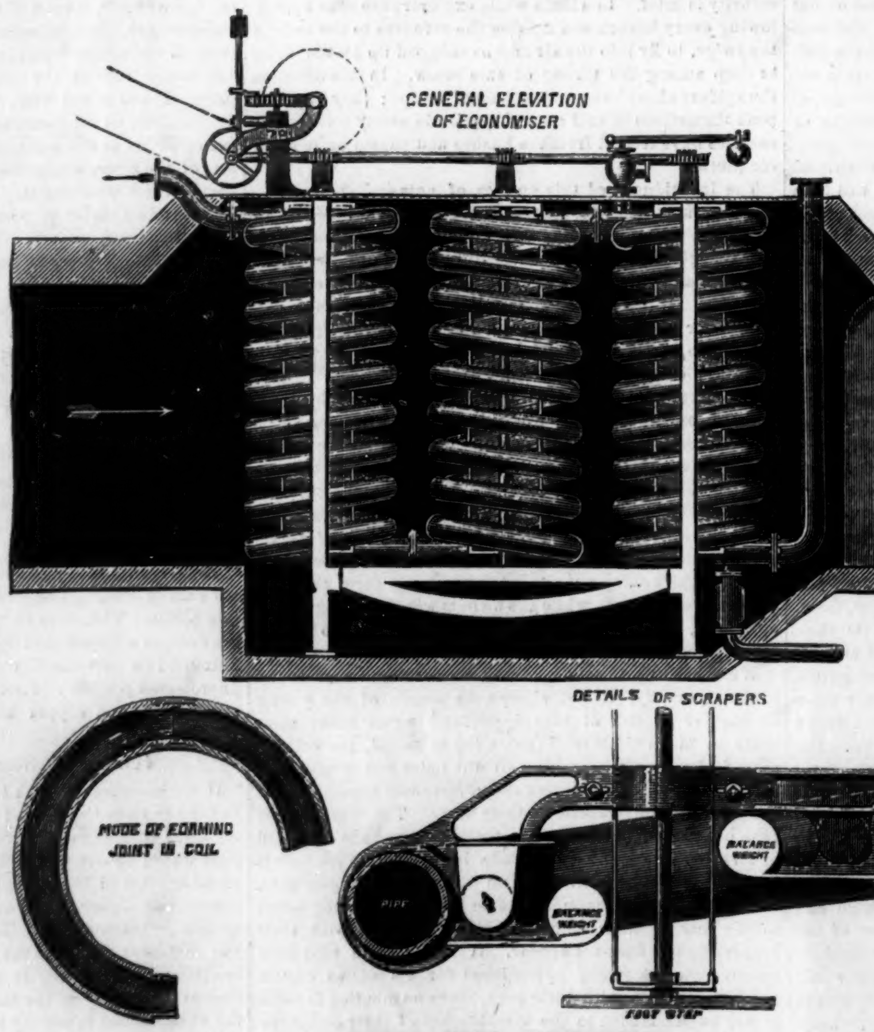
IMPROVED FUEL ECONOMIZER.

Among many novel devices displayed at the recent exhibition of fuel-economizing appliances, held at Manchester, England, is a steam generator composed of three coils of cast iron piping, of four inches internal diameter. These coils are not cast whole, as stated in the inventor's descriptive circular, but are formed of a number of half circles, bored and turned to spigot and faucet joints. The ends of these half circles are reduced to three inches in diameter, and have ribs cast on the exterior surface. After the segments have been placed together an iron hoop or thimble is cast on over the joints, and, by the contraction of the metal in cooling, draws the ends of the pipe close together. The exterior of the thimble is of the same diameter as the pipes, and thus a perfectly smooth joint is obtained for scrapers to travel over; the pipes are held securely together, while all cement or rust joints are dispensed with.

Should a coil become fractured it can be repaired by splitting two hoops and removing the damaged segment.

The form of scraper will be readily understood by referring to the engraving. One half rests upon the pipe, embracing the upper portion of it, while the lower scraper is kept up to the pipe by means of a balance weight; these scrapers are pushed forward by arms or propellers fastened to a center shaft, driven by a worm and wheel at the top of the machine, and supported by a footstep in the center of each coil; the scrapers follow the line of pipes until they reach the bottom, when, by the action of the reversing motion, they again ascend the coil to the top. These scrapers will, undoubtedly, clean the coils from soot, provided the pipes are cast truly cylindrical and the scrapers made to fit them exactly; but in the apparatus exhibited at Manchester this was not the case—the pipes being very rough castings and far from cylindrical, consequently many portions of the pipes were untouched by the scrapers, the points of which were frequently more than an inch apart. The inventor states that this machine was not made in his own foundery, but that in all economizers now supplied by him he will guarantee the accuracy of the form of the coils.

Many advantages are claimed for this economizer over those with vertical pipes. The first is that the whole piping presents a surface for the heat to beat against, the back part of the coil being exactly opposite the front space. We can see no difficulty, says the *Engineer*, to which we are indebted for the engraving, in arranging vertical pipes, so that those in the second row should be placed exactly opposite the spaces between the pipes in the first row, and so on alternately. Another advantage claimed is the rapid and continuous circulation of the water, there being only one unbroken stream, free from all sharp turns and angles, thus avoiding strains upon the pumps and joints. By means of this rapid circulation it is maintained that incrustation and deposit of scale on the interior of the pipes are avoided, and their heating surface kept uninjured. The feed water enters at the bottom of the coil furthest from the boiler, which is the coolest end; it passes into the second coil at the top, and, descending through it, enters the third coil at the bottom, becoming gradually hotter until it enters the boiler at a temperature varying from 200° to 300°. From the absence of abrupt corners and bends, the coils can be well cleaned out by blowing through them with steam. It stands independent of all brickwork, and is self-contained in its own frame, which reduces the cost of fixing. The three coils are estimated by the inventor to give as good results as an economizer comprising seventy vertical pipes.



BELL'S FUEL ECONOMIZER.

American and European Locomotives.

American engines have, as it were, gradually crystallized into certain definite and fixed forms. Outside cylinders and inside frames are now universally used here, whereas, on the continent, cylinders and frames are sometimes placed inside of the wheels and sometimes outside. The steam chests here are always placed on the outside and top of the cylinders; thus there are often placed on the side and inside the frames. Almost the only kind of pistons which seems to be used there is that made with solid heads, with simple grooves turned on the outside, into which steel, cast iron, or brass rings are sprung. Here the varieties of packing in use are numberless. For simplicity and cheapness the European is certainly very much superior to ours. Here the only valve gear now made is the shifting link motion worked from eccentrics on the main axle; there the shifting link, the suspended link, the Allen or straight link, the Walschaert, and several other kinds of valve gear are used. Some of them are worked from eccentrics placed outside of the wheels; and in at least one engine we notice that the axle bearings are outside of the wheels, and then the eccentrics are placed next the bearings, and a crank outside, to which the connecting rods are attached. All wheel centers are made of cast iron; there, of wrought iron. In the tyres of our truck wheels we are imitating Europeans, and steel tyres are now much used here for that purpose. The springs in American engines are, if we except the Boston and Albany railroad, always placed above the axles and frames. In Europe they are often below. Here they are, excepting in four-wheeled engines, always arranged with equalizing levers; there this is not always the case. The use of plate frames is universal in Europe, whereas in this country they are now never used.

In the construction of locomotive boilers there is also a very great difference in their practice. The steam dome is there always placed either about the middle or near the front end or smoke box. The Becker pattern of boiler is also much used, especially in Germany and Austria. In this plan the outside of the fire box, instead of being arched, is rectangular, that is, the top of what we call the wagon top, instead of being round, is flat, and is raised somewhat above the barrel of the boiler. The corners are, however, rounded somewhat. The crown sheet, instead of being stayed with crown bars and braces, is supported by long stay bolts screwed through the outside shell and the crown sheet. Some of the engines which are to be built at the Grant Locomotive Works, for a Russian road, are to be made in this way. This is, we think, a very excellent plan, and is quite certain to be adopted in this country when its merits become known. Shaking grates are, however, seldom shown in the illustrations of European engines; but grates very steeply inclined are still much used there. It is very singular that in Europe the exhaust steam almost universally is allowed to escape at the base of the smoke stack instead of the bottom of the smoke box as is the practice here. It will also be observed that there many of the smoke stacks are made conical; that is, the base of the inside of the stack is smaller than the upper part. We have seen it stated that it is found that the steam blast is much more effective with this form than with a straight stack. We do not know, however, upon what the assertion was based, and would be glad to get some further information in reference thereto. The differences in points of detail are almost numberless, and are well worth study. The reasons for many of these differences would be very interesting if carefully examined, and we intend to return to the subject again. A very striking fact, however, is the much greater variety in the methods of construction adopted in Europe than is in use here. The reason for this we believe to be, singular as it may seem, partly political. The suppression, or rather repression, of individuality under republican governments has often been remarked. In this country, perhaps, no principle is more generally believed than that "the majority should rule." The result is that this axiom produces a kind of intellectual subserviency of the individual to the will of the majority, which thus, to a very great extent, becomes the standard of right and wrong

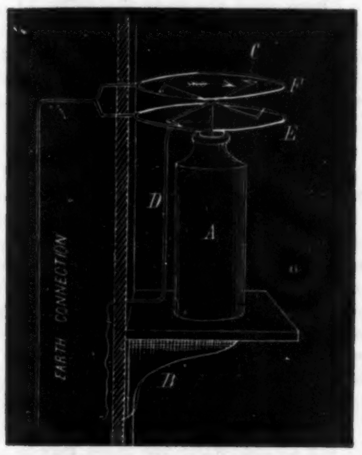
If, therefore, any new method of construction fails to be approved by a majority, it is abandoned. We will not undertake here to determine whether the suppression of individuality is a gain or a loss. It is quite certain that originality is very expensive when it exercises itself in the construction of locomotives or other railroad machinery, and that the Chinese virtue of uniformity has much merit, and is often profitable when great ingenuity and skill would not be.—*Railroad Gazette.*

Correspondence.

An Electric Toy.

To the Editor of the Scientific American:

I send you herewith a sketch of a scientific toy, which I have recently constructed and placed on a bracket in front of the desk in my engine room. The main belt of the engine is 30 inches in width, and about 120 feet in length, and runs from south to north, at an angle of about 45°, and with a velocity of 2,500 feet per minute; it is highly electrical.



The idea occurred to me that the electricity so developed might be made use of for mechanical or other purposes; and having seen an engraving of what is called an electrical wheel, I constructed one as shown herewith, but without the coils. A is a vial, about 6 inches in length by 1½ inches in diameter, the bottom of which is inserted in a cavity in the bracket, B. In the center of the cork is inserted the eye end of a darning needle, the point projecting upward about 2 inches, on which rests the wheel, C, which consists of two pieces of copper wire, 1-32 inch in diameter and 7 inches in length, placed at right angles to each other; their centers are flattened and soldered together, and half an inch of the end of each arm is bent at a right angle, all in the same direction, and filed to a point. D is a copper wire, one eighth inch in diameter, one end of which rests against the needle, the other running in front of and about 6 inches distance from the belt, and terminating in 5 or 6 points, 2 inches long, projecting toward it.

On connecting the conducting wire with the needle, my wheel immediately started off at a speed of 100 turns in 50 seconds. I soon ascertained that, by placing a good metallic conductor beneath the wheel and making an earth connection, I could add materially to its speed. Accordingly I placed a copper coil, E, 5½ inches in diameter, one inch below the wheel, connecting it with the gas pipe, which accelerated its speed to 148 turns in 50 seconds. Soon my wheel began to gyrate even to an angle of 20°. This annoyed and puzzled me. I eventually found that, by adding another coil, F, one inch above the wheel, and connecting it with the earth, I not only restored its equilibrium, but also increased its velocity to 173 turns in 50 seconds.

When the air is dry and frosty, I have had it running as fast as 280 turns per minute, and the ozone given off by the wheel is apparent to the senses at a distance of several feet. It also acts as a barometer, indicating (by increasing or diminishing its speed) atmospheric changes several hours in advance. It is especially lively on the approach and during the prevalence of a northeast snow storm; but with the wind anywhere from east to south, it will scarcely move at all.

The apparatus can be easily constructed by any person of ordinary intelligence, and it makes a very interesting scientific apparatus. It can as well be located in the counting room or ffice as in the engine room.

328 Delancy street, New York city. EDWIN LEACH.

Elasticity and Slipping of Belts.

To the Editor of the Scientific American:

It is pretty generally admitted, though sometimes contested, that any belt running upon two pulleys, one the driver and the other the driven, must slip on both when any appreciable amount of power is being transmitted by it. It seems to be very evident that, if a belt is passing from a state of greater to one of lesser tension, or *vice versa*, in its passage around a pulley: in the former case it must undergo contraction, and in the latter case extension, in direction of its length; and we know that a belt always exists in a different state of tension in the parts entering upon and leaving the given pulley. If, then, in passing around the driving pulley, a belt undergoes contraction, and on the driven pulley, extension, there can be no point of the belt but must have a sliding movement on both pulleys, and thus result in the driven pulley having a lower velocity than would be mathematically due to the diameter of the pulleys. Thus, of two pulleys of exactly equal diameter, one driving and the other driven, the latter must have the lower velocity. In cases where high speeds are to be obtained by means of belts and the prime belt, that from the first driver, has a low velocity, this may become an important consideration.

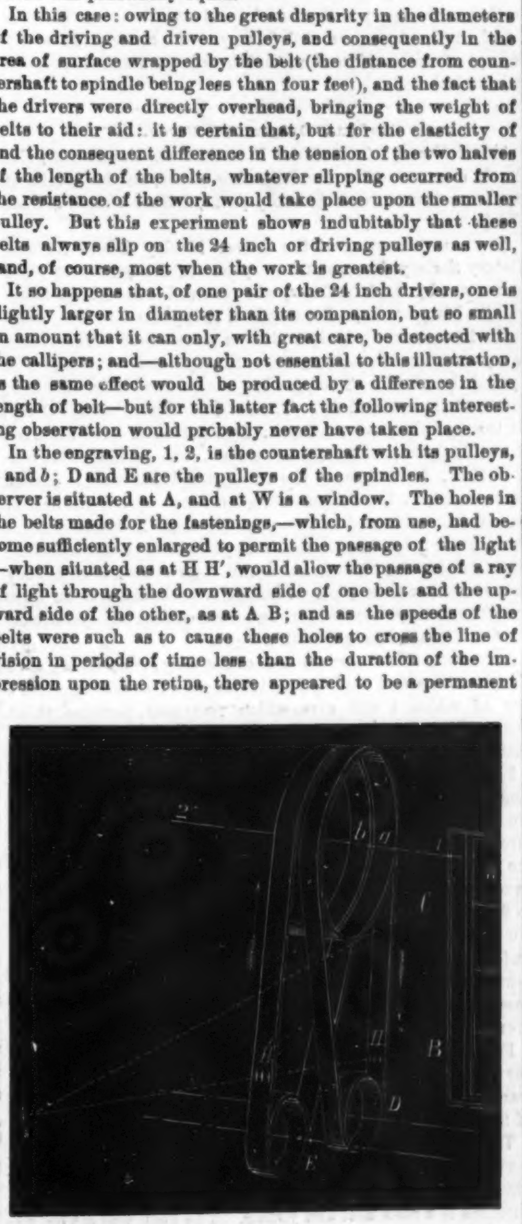
I recently, quite accidentally, observed a peculiarly delicate and interesting illustration of this property of belts, especially illustrative of the invariable slipping upon the driving pulley; and I think it will be of interest to your readers, as it establishes that fact in a very beautiful manner.

I have, in my factory, a number of pairs of spindles running at about 5,000 revolutions per minute. Each of the pairs is driven from one countershaft by two separate driving pulleys, situated nearly close together, as in the illustration, and the spindle pulleys are so situated, one in advance of the other, as to take the belts from them. The countershaft being directly over the median line between the two spindles, the two belts were practically of equal length. The spindles are alike in all material respects, and carried 4 inch pulleys, the drivers on the countershaft being 24 inches in diameter. The work done by the spindles alternated regularly about 60 times per minute, the belt of one spindle having—while the other was at work—nothing more to do than to turn the spindle in its bearings; and while the feed mechanism of the machine containing the spindles was not in operation, neither belt had any more to do than simply turning the spindles, which was practically equal.

In this case: owing to the great disparity in the diameters of the driving and driven pulleys, and consequently in the area of surface wrapped by the belt (the distance from countershaft to spindle being less than four feet), and the fact that the drivers were directly overhead, bringing the weight of belts to their aid: it is certain that, but for the elasticity of and the consequent difference in the tension of the two halves of the length of the belts, whatever slipping occurred from the resistance of the work would take place upon the smaller pulley. But this experiment shows indubitably that these belts always slip on the 24 inch or driving pulleys as well, and, of course, most when the work is greatest.

It so happens that, of one pair of the 24 inch drivers, one is slightly larger in diameter than its companion, but so small an amount that it can only, with great care, be detected with the callipers; and—although not essential to this illustration, as the same effect would be produced by a difference in the length of belt—but for this latter fact the following interesting observation would probably never have taken place.

In the engraving, 1, 2, is the countershaft with its pulleys, *a* and *b*; D and E are the pulleys of the spindles. The observer is situated at A, and at W is a window. The holes in the belts made for the fastenings,—which, from use, had become sufficiently enlarged to permit the passage of the light—when situated as at H H′, would allow the passage of a ray of light through the downward side of one belt and the upward side of the other, as at A B; and as the speeds of the belts were such as to cause these holes to cross the line of vision in periods of time less than the duration of the impression upon the retina, there appeared to be a permanent



opening through them. If the pulleys, *a* and *b*, were exactly of the same diameter, and the feed works of the machine not in operation, the points, H and H′, would, after completing a circuit, reappear in the same position; but owing to the slightly larger diameter of the pulley, *b*, the ray of light, when both spindles were idle, had a very regular upward movement until cut off by the pulley, *a*, as shown at C A, and, after a short time had elapsed—a little less than a minute, by repeated timings—would reappear at B A; and as the belts were running at about 5,000 feet per minute, it will readily be seen how small was the difference in the diameters of the pulleys, *a* and *b*. Now, when the spindle, D, was at work, E being idle, the downward motion of the point, H, became at once retarded, and the upward motion of the ray would become suddenly accelerated; but when the spindle, E, was at work, and D idle, the point, H′, became in turn retarded, and the ray would either come to a stand still or slightly descend, according as the material being operated upon by the machine offered more or less resistance to the cutting tools. The descent, however, was never so great as the ascent; and whether the ray passed upward regularly, as when the spindles were both idle, or intermittently, as when they alternated in their work, its recurrence at B A always took place in the same period of time. The intermittent motion of the ray of light could only be produced by the slipping of the belts on the upper pulleys, except that a small fraction of it might result from the stretching of the belts between pulleys, that is, between the leaving one pulley and entering upon the other; but that this must be very small will be evident from the fact that, during one second (the period of one alternation of work from one spindle to the other and return), the belt would make about 21 complete circuits, or pass from pulley to pulley 42 times in that period; therefore the change in tension in the two halves of the belt's length must take place principally upon the surface of the pulleys.

I think this example shows conclusively that, in any belt whatever, the side in contact with a pulley has a greater velocity than the surface of the pulley itself.

New York city. JOHN L. HAWKINS.

Measuring the Width of a Stream.

To the Editor of the Scientific American:

In surveying, it is often necessary to ascertain the width of river, pond, or other body of water, with the least possible delay.

Let A B represent the line of survey (the course being due north), striking the river bank at B. Have a flag set on this line at C. Take your station at D, at a right angle with your line, B A, at any convenient distance, with or without measurement. Set your compass at D, and bring it to bear on your flag at C. By observation you find the course N. 13° E. Reverse your compass, taking your course S 13° E. Send a flagman back on the survey line, keeping in range with B C, until he comes in range of your compass sight at E. Measure from B to E, and you have the distance from B to C.

Farmington, Iowa. JOHN CROSS.

The Relative Attraction of the Sun and the Earth.

To the Editor of the Scientific American:

Permit me to correct a serious mistake contained in Dr. Vander Weyde's communication, published in your issue of April 18th. Your correspondent incorrectly asserts that I have constructed an apparatus for measuring the changes of terrestrial attraction, consisting of a heavy iron globe floating in mercury; regarding which he remarks "that a floating object is identical with a lever scale, as the liquid balances the floating body, and any change in the gravitation will equally affect both; so that such an apparatus would show no change whatever, even when transported to the moon or to Jupiter." Dr. Vander Weyde appends to his irrelevant remark the following unwarrantable conclusion: "It is, therefore, not in the least surprising that Captain Ericsson, according to his own showing, had no results." The reader will be surprised to learn that my apparatus, the principle of which Dr. Vander Weyde evidently does not understand, has been constructed for the sole purpose of proving practically that, at the rising and setting of the sun, solar attraction exerted on a body resting on the surface of the earth is exactly balanced by the centrifugal force acting in an opposite direction, called forth by the earth's orbital motion round the sun. The reader will find, on referring to my communication inserted in the SCIENTIFIC AMERICAN, March 14, 1874, that the result of the experiment with the floating iron ball was mentioned in my demonstration relating to solar attraction simply for the purpose of convincing Mr. W. B. Slaughter, by actual experimental test, that solar attraction is neutralized by orbital centrifugal force. The reader will also find, by referring to the said demonstration, that, while the sun's attraction on the iron globe exerts a pull of fully 748 grains, and that while a tractive force of a few grains suffices to move it across the vessel of mercury in which it floats, yet the globe remains perfectly stationary on the surface of the liquid metal when subjected to the stated pull of 748 grains exerted by the attraction of the rising sun. Consequently the instituted experiments with my apparatus, which in the opinion of Dr. Vander Weyde have produced "no results," prove incontestably that the centrifugal force, called forth by the orbital motion of the iron globe, exactly balances the attractive energy exerted on its mass by the sun at the moment of rising and setting. I will not detain the reader by commenting on Dr. Vander Weyde's criticism of my solar attraction apparatus, since it is based on the irrelevant fact that "a floating object is identical with a lever scale, as the liquid balances the floating body." Moreover, the reader cannot fail to perceive, without further discussion, that, according to his own showing, Dr. Vander Weyde does not comprehend the principle of the apparatus nor its object.

J. ERICSSON.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for May, 1874.

Mercury.

Mercury rises on the 1st a little after 4 A. M., and sets a little before 5 P. M. On the 31st, it rises about 5 A. M., and sets near 8 in the evening.

In the first week of May, it should be looked for before sunset, and near the last of May after sunset. It is too near the sun, in apparent position, to be seen between the 15th and 29th.

Venus.

Venus rises on the 1st at 5h. 50m. A. M., and sets at 8h. 20m. P. M. On the 31st, Venus rises at 6h. 7m. A. M., and sets at 9h. 21m. P. M.

On the evening of the 3d, Venus and Mars will have very nearly the same right ascension, and will differ little in declination, Venus being a little further south in declination. Mars passes the meridian one minute later than Venus.

Mars.

On the 1st, Mars rises at 5h. 53m. A. M., and sets at 8h. 27m. P. M. On the 31st, Mars rises at 5h. 8m. A. M., and sets at 8h. 12m. P. M.

Mars is very small at this time, but its ruddy light will enable one to recognize it after sunset, and its nearness to Venus on the 3d will be a very marked phenomenon.

Jupiter.

Jupiter rises on the 1st at 2h. 39m. P. M., and sets at 3h. 11m. the next morning. On the 31st, Jupiter rises at 0h. 41m. P. M., and sets a little after 1 the next morning.

Although we are moving away from Jupiter, and it is becoming smaller, it is still the great beauty of our evening skies, and its satellites, with their varied changes of position, can be seen with an ordinary ship's glass. On the evening of the 10th the second satellite will be invisible to glasses of small power by being between us and the planet until after 8 P. M., and the fourth will become invisible after 9 P. M., by the planet's passing before it, or between the satellite and the earth.

Saturn.

On the 1st Saturn rises at 1h. 33m. A. M., and sets at 11h. 25m. A. M. On the 31st Saturn rises at 11h. 38m. P. M., and sets the next forenoon at 9h. 25m.

Saturn should be looked for in the morning, as it comes to the meridian at 6h. 25m. on the 1st, and at 4h. 29m. on the 31st. Although it is in southerly declination, and is only 31° above the horizon in this latitude, its ring can be seen with a glass of low power.

Uranus.

On May 1, Uranus rises at 10h. 45m. A. M., and sets at 1h. 10m. the next morning. On the 31st, Uranus rises at 8h. 51m. A. M., and sets at 11h. 15m. P. M.

Neptune.

Neptune rises in the early morning and sets about 6 P. M. on the 1st and 4 P. M. on the 31st. It requires a very good telescope.

Sun Spots.

The record is from March 14 to April 18. Observations have been seriously interrupted by cloudy weather, and high winds have in some cases prevented good definition. Spots have, with one exception, been small, and, like those of last month, have shown sudden and decided changes from day to day. This was noticed particularly on March 27, when there was not a trace of several spots which had been scattered over various parts of the disk on March 25. Again, all those seen on March 27 had disappeared by noon of March 28, and several new ones had broken out. On the other hand, a group which appeared on March 30, just within the eastern limb, remained invariable in its regular passage across the disk as long as the weather permitted it to be seen. This group was quite large, so that it could be seen through smoked glass. Faculæ have usually been noticed.

Barometer and Thermometer.

The meteorological journal from March 15 to April 18 gives the highest barometer, April 13, 30·55; the lowest barometer, April 10, 29·56; the highest thermometer, March 18, at 2 P. M., 62°; the lowest thermometer, March 24, at 7 A. M., 11°.

AMOUNT OF RAIN

The rain which fell between the night of March 16 and the evening of March 17 amounted to 0·57 inches.

The rain which fell between the morning of April 7 and the morning of April 9 amounted to 0·82 inches.

American Agricultural Machinery in Germany.

A German correspondent writes in the New York *Herald* that, until a very recent date, Messrs. Ransome & Sims, with a few other English manufacturers of agricultural machinery, monopolized nearly all the trade of the European continent. Now American makers are running them hard. The imports of agricultural machinery from America into Germany commenced about seven years ago, and the business then has rapidly developed into an important branch of commerce. The chief depots of American agricultural machinery are Bremen, Hamburg, and Stettin. The principal articles sold are mowers and reapers. Lawn mowers are the largest item. Pitchforks come next. A very little has as yet been done in threshing machines.

In 1873 about 8,000 American mowers and reapers were sold on the European continent. During the present year, it is estimated that there will be orders for at least 12,000 mowers and reapers, which will represent a sum of $1,000,000, or thereabouts, payable to the United States as a net result of the transaction.

The firms at present doing the largest business are: Messrs. Adriance, Platt & Co., of New York; D. M. Osborne & Co., New York; W. A. Wood & Co., Hoosick Falls, New York.

The German manufacturers cannot turn out good agricultural machinery. Many attempts have been made by them to copy American workmanship, but none have been satisfactory. Buyers on the European continent, though hard to convince, are now agreed that American cast iron is the strongest in the world. It has an advantage of twenty-five per cent over German cast iron in strength, and is nearly 16 per cent stronger than English cast iron. So the export of agricultural machinery to the European continent has become a prominent feature of American trade, and is susceptible of a still further development.

Wherever the emigration movement is active, a large number of agricultural machines are always salable. In the city of Breslau especially, where estates are large and farm laborers constantly becoming fewer, there is a promising market, which has already yielded good returns, and is likely to do so for a long time to come. The loss of hands in Germany during the French war, and the fact that the landlords have much money and few workmen, should induce American manufacturers of agricultural machinery to direct their attention to Germany with a careful and attentive eye. The profits of the business are satisfactory, and payment generally prompt or easily enforced, so that there is the smallest possible risk of bad debts.

Curious Origin of Fires.

Alfred Tozer, of the Chief Fire Station, Manchester, England, communicates the following paper, on the origin of great fires from a natural history point, to Hardwicke's *Science Gossip*.

At a recent meeting of the Lower Mosley Street Natural History Society, I submitted a piece of leaden water pipe, sent to me by Captain Drew, who received it from Mrs. Bakewell, St. Mary's Gate, in January last. It appears that Mrs. Bakewell's kitchen in St. Mary's Gate is infested with rats: they have, on several occasions, bitten through the water pipe and flooded the place. The pipe has been twice bitten through, and the hole soldered up. The rats, no doubt, being thirsty, bit through the pipe to allay it. Two instances have occurred at Phillips' warehouse, Church street, one in 1851, the other in 1856: in both cases the rat gnawed through a leaden gas main pipe a few inches above the floor. Other similar instances have occurred of rats gnawing a gas in mistake for a water pipe: it has been thought they heard the water bubbling in the gas pipe, and have not found their mistake until they have penetrated the pipe. Phillips' warehouse was on both occasions damaged by fire through some of the employees seeking for the escaping gas with a light.

A fireman, in the performance of his duty, often meets with many curious and interesting instances of causes of fires, a few of which I will give, which you may, perhaps, think worth while to find a corner for in your interesting *Gossip* on natural history, etc.

I have attended and traced several instances of fires occurring through rats and mice gnawing lucifer matches. Matches are now dipped in paraffin wax instead of sulphur, as before; the rats or mice have carried them under the floor for the purpose of gnawing off the wax; in doing so, their teeth have come in contact with the phosphorus at the ends, and so fired them. In 1856 I attended a fire at the Sultan's Palace at Scutari, Asia Minor. After the fire, I gathered from under the flooring a quantity they had been gnawing. Some years ago a fire occurred in London, caused through a jackdaw getting at a box of lucifers, and pecking them until it set them on fire.

Fires have occurred through rats and mice conveying, under the flooring boards, oily and fatty rags, which have afterwards spontaneously ignited. This is rather a common cause of fires in cotton mills.

The following is an extract from the *Journal* of the United Service Institution, Whitehall yard, London, No. 52, for 1868: "One of the presents sent to the Museum of this Institution is a rat's nest and young. The nest was set on fire by a lucifer match, ignited by the old rat as she worked it into her nest. Lieutenant A. H. Gilmore, R. N., states that a fire occurred on board Her Majesty's ship Revenge from a similar cause."

Cats and dogs have caused fires in various ways; such as upsetting explosive and inflammable things into fires and lights, also through lying inside fenders and under fire places. Hot coals have fallen and adhered to their backs, which caused them to beat a hasty retreat, no doubt being anxious to get rid of the annoyance as soon as possible. They have sometimes succeeded by rolling or rubbing on carpets, curtains, beds, straw, shavings, and other inflammable things. The last instance I recollect occurred at a baker's shop in Albion street, Gaythorn. A dog was lying under an oven fire, a piece of chip fell from the fire on to his back; he immediately ran to some shavings, rolled upon them, at the same time setting them on fire before the eyes of his master. In 1863, three distinct fires were caused in one room of a gentleman's house in Canonbury, Islington, through a cat lying inside the fender, when some hot ashes fell out of the fire on to its back, which caused it to rush about the room, when the cinders were deposited in different places, which set fire to the carpet.

That mischievous animal the monkey has lent its aid to the devouring element. Fires have occurred through its agency, in a similar manner to cats and dogs, also through its playing with fire in various ways. In one instance a monkey upset a charcoal brazier, and set a room on fire. Many—yes, very many—fires have occurred through our domestics hunting bugs and other small fry by the light of a candle or lamp. In their anxiety, especially, to hunt fleas, they forget they may produce an enemy much more to be dreaded. Many fires also occur through persons fumigating apartments to get rid of bugs and various kinds of vermin.

A few instances have occurred through the concentration of the sun's rays upon glass fish globes. On the 16th October, 1845, at two P. M., Mr. Philbrook's residence, Mill street Worcester, was set on fire through the concentration of the sun's rays upon a water croft standing upon a table. Colored bottles in chemists' shops, cracks, and bull's eyes in glass have been known to focus sufficient heat from the sun to set buildings on fire.

Fires have occurred through the spontaneous ignition of pigeons' dung under the slates and tiles of houses. Professor Buckland traced two fires to this cause. See *Builder*, 28th September, 1844.

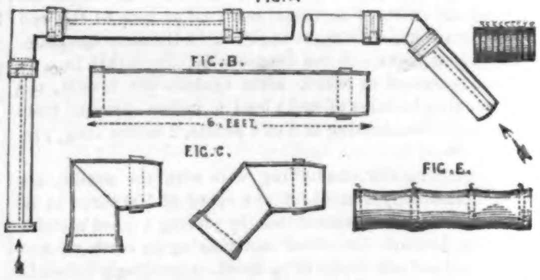
Birds' nests under the eaves and wooden crevices of houses have been frequently set on fire through sparks from a neighboring chimney, and have contained sufficient inflammable matter to set fire to the buildings.

Although I have given the dogs the credit of producing work for the firemen, still it would not be fair if I were to omit to mention that they have frequently discovered and given timely notice of fires; and many an anecdote can be told of the very great interest dogs take in and at fires.

Flexible and Wrought Iron Air Tubing for Mining Purposes.

A correspondent of the London *Mining Journal* states that air drifts have lately been driven by the aid of sheet iron tubes fitted into each other, spigot and faucet fashion. A great saving has thus been caused by doing away with the necessity of driving, in many cases, an expensive temporary drift as a return for the main drift, to be abandoned when the desired point is reached and the ventilation established.

The great difference in cost between driving an expensive air way and using the tubing will be appreciated by mining engineers; and in the case of the drift, it may not be required after the holing, while the tubes may be used over and over again. Good mining has often been done with a brattice wall, but the drift or heading has, in nearly all cases, to be made larger than eventually required, making the cost of the wall much more than the tubes, besides being a much slower and more tedious operation. In many cases these tubes are invaluable, such as opening places much broken and fallen, in which it is impossible to erect any of the ordinary modes of brattice. Being made of stout sheet iron (Figs. A, B, C, showing the lengths of pipe, angles, and



manner of joining), riveted and with well fitted joints, and having bends of all angles, we have an air way vastly improved over the old forms of brattice, either of timber or cloth, which cannot be made thoroughly airtight, being therefore, for long distances, quite useless, especially where strong currents of air are requisite to enable blasting powder to be used. The writer saw, in Belgium, a long single drift being driven to some workings on the opposite side of a synclinal, or basin, in the coal measures. Iron tubes were led in of about 15 inches diameter, and air was propelled through them by a small engine driving a fan. The drift was driven by means of the Villepique perforator, which was worked by compressed air, advantage being taken of this power to work the small engine. Large quantities of gunpowder were daily consumed, and the immense amount of smoke generated thereby was efficiently cleared away by these means.

A very handy tubing (Fig. E) made of brattice cloth, kept in a circular form by means of hoop iron rings, was also used; to each ring is fastened a hook, so that the tubing is easily and rapidly hung up to the roof. Their portability is a great recommendation to miners, as they pack up like a concertina, as shown in the engraving, hundreds of yards thus occupying a very small space.

Both of these air tubes are destined to be largely used in collieries; and for mines where the wooden box has so long been used, they will certainly be a great boon.

Perils of Ballooning.

A party of seven persons, two females and five men, under charge of the aeronaut Barbier, essayed an aerial excursion recently at San Francisco, in a balloon carrying 60,000 cubic feet of gas. A strong wind blew at the time. The ascension was a success, an altitude of 7,000 feet was attained. The descent was disastrous. The anchor rope caught on a building and the rope broke. Up darted the balloon 400 feet, when a crack was heard; the balloon burst open and down it came, thumping the passengers upon the ground with great violence, capsizing the car, entangling the passengers in the rigging and dragging them along the ground for a third of a mile. Finally they were rescued, bruised sadly, but no limbs broken.

THE MEETING OF THE NATIONAL ACADEMY OF SCIENCE.

The National Academy of Science, which held a meeting last October in this city, is again in session at the Smithsonian Institution in Washington. This body, as we before have had occasion to explain, is the highest scientific association in the country, and includes among its members all or nearly all eminent American scientists. The papers read are therefore of considerable importance, and in the abstract which we present below will be found a careful *resumé* of their contents.

Professor Joseph Henry presided over the deliberations, and recently rendered a graceful compliment to the President of the American Association for the Advancement of Science, Professor Le Conte, in calling upon him to open the proceedings with the reading of his paper on the classification of the *rhiphophorus coleoptera*. The American Association, by the way, is a body which is perhaps more popularly known than the National Academy; but we can hardly agree with a con temporary which alludes to it as a rival organization. The cause of Science is one that calls for cöoperation and not competition; and while societies may have distinctive names, they all strive for the same object in unison.

Professor Le Conte makes a division of the insects above named into three series: (1) Haplogastra, having abdomen alike in both sexes; ventral segments not prolonged upward into a sharp edge. (2) Allogastra, abdomen dissimilar in the two sexes; ventral segments prolonged upward, forming a sharp edge. (3) Heterogastra, abdomen alike in both sexes; ventral segments prolonged upward to fit into the elytral groove. Many other distinctive characteristics were given, with a detailed description of the very numerous genera belonging to each of the series.

Professor Fairman Rogers followed with a paper on apparently an odd subject for scientific discussion, namely,

AN AUTOMATON TO PLAY TIT-TAT-TOO.

Babbage, he said, in speaking of his analytical engine, has suggested that a machine might be made which would play a game of combination, such as drafts, provided the maker of the machine himself would work out perfectly the sequences of the game. Professor Rogers finds that the sequences of tit-tat-too are easily tabulated, and hence an automaton may be made which will play the game as follows: The opponent to the automaton makes the first move in the game, and in so doing causes a certain cylinder or equivalent device to change its position. This, from the construction of the apparatus, causes the automaton to make that play which the proper sequence of the game requires, and at the same time moves the corresponding cylinder into position. The next play of the opponent moves the third cylinder, and the combination of the three cylinders determines the action of the automaton for the fourth; and so on throughout the sequence. If the player plays perfectly, the game will be drawn, as the automaton's play will be mathematically cor rect. If the opponent makes a mistake, the automaton, by a simple device, takes advantage of it, and makes such a play as to win the game. The object of the speaker was to show that such mechanism, applied to apparatus for registering physical phenomena or for performing geometrical or mathematical operations, may enable such mechanical devices to have a use much more extended than heretofore.

THE FUNCTIONS AND MECHANISM OF AUDITION

was the subject of a paper by Professor A. M. Mayer, in which he shows that the significance of the anatomical relations of the parts of the ear is to bring the sound vibrations to act with the greatest advantage on the co-vibrating parts of the ear, and to cause these parts to make one half as many vibrations in a given time as the tympanic or basiolar membranes. This is demonstrated by an extended review of the functions and possibilities of different portions of the auditory apparatus. In the course of this train of argument, Professor Mayer advances the view that what are known as the hair cell cords, having swellings in the middle of their length which cause them to act like loaded strings, are probably so constituted that each hair cell cord is adapted to co-vibrate with only one special sound, and that a cord in the ductus of the ear will vibrate only half as often in a second as the basiolar membrane to which it is fastened. In a second paper on

THE DURATION OF THE SENSATION OF SOUND,

Professor Mayer said that experiment proved that the residual sensation only occupied one five-hundredth of a second in the case of 40,000 vibrations per second; but in the case of 40 vibrations to a second, the residual vibration was one eleventh of a second. He concludes that the whole ear vibrates as one mass, and the durations of these oscillations of the whole ear are far too short to remain one thirtieth of a second. He thinks that this explains our inability to distinguish the actual pitch of sound when that pitch exceeds certain well known limits.

THE REFLECTION OF SOUND FROM FLAMES AND HEATED GLASSES

was the subject of another paper by the same author. Two similar resonators are placed with the planes of their mouths at right angles to each. Then in this angle Professor Mayer firmly fixes the tuning fork corresponding to the resonators, so that the broad face of one of its prongs faces the mouth of one resonator, while the space between the prongs faces the mouth of the other. Complete interference of the sounds issuing from their mouths is obtained, and the only sound that reaches the ear is the faint sound given by the fork's action on the air outside the angle included by the mouths of the resonators. If in these circumstances we close the mouth of either one of the resonators with a piece of cardboard, the open resonator will strongly re-enforce the sound of the forks. If we now cover the mouth of this resonator with cardboard, we shall again have silence.

Now substitute for cardboard, when both resonators are open, the flame of a bat's wing gas burner, with one resonator, and use something more permeable to sound than the cardboard with the other. By trying a series of more and more permeable diaphragms, it was found that tracing paper just equaled the effect of the gas flame in guarding the mouth of the resonator from the entrance of sound. A sheet of heated air above the gas burner was found to be exactly equivalent to the gas flame. The passage of a sheet of cold coal gas over the mouth of the resonator produced a similar effect; and so also did carbonic acid gas, though in less degree; but cold, dry hydrogen closed the mouth of the resonator more effectively than either of the above gases, though not equal in this respect to the heated air above the bat's wing flame. Among other curious results, Professor Mayer has ascertained that there is an absorption of sound in the bat's wing flame; that the flame is heated by the sonorous vibrations which enter it as such, and issue as heat vibrations. He has endeavored to obtain a quantitative mathematical analysis of this absorption and hopes for exact results.

Professor Norton, of Yale College, referring to

TESTS OF THE STRENGTH OF PINE,

said that after repeated strains a molecular change took place in the wood, and the effect of strain, after an interval of rest, to a great extent not only passed away but even left the stick with less set than it had a short time before. As one of the results obtained, it appears that a load equal to one fourth of the breaking weight produces a permanent set, and that repeated applications of this load from day to day are attended with a continually increasing set. It results that such wood should never be subjected in any structure to one fourth of its breaking strain.

THE FUNCTIONS OF THE BRAIN AND NERVES

was the title of a very interesting discourse by Dr. Brown-Séquard. The theory ordinarily assumed is that sensation is conveyed through the body by the nerves, as the bells rung in any part of a hotel have the sound conveyed along wires to a central office where the fact is recognized from where the call may come. This assumption is as false as it is simple. There is no necessity for more than a very few fibers to establish communication between the brain and the spinal cord. It is more like a telegraphic communication than a movement along a wire, by which sensation is conveyed from the periphery to the brain, or the brain transmits its orders to the periphery. If, said the speaker, a piece of ice is laid upon my foot, I have at once the sensation of a contact, sensation of a temperature, the sensation of the extent of the surface of the ice that touches me, the sensation of the weight of the ice, and, if it is left upon my foot, the sensation of pain, and the sensation of the skin to which the ice is applied. All those forms of knowledge are communicated at once. I believe that all these impressions are communicated to the spinal cord, which as a single wire transmits it to the brain.

Now as to the two sides of the brain: The old view was that the left side of the brain governs the movements of the right side of the body, and the right side governs the movements of the left side of the body; and that there is a similar view respecting perception and sensation. Facts oppose this view. One third of one half the brain may be utterly destroyed without any symptom of the injury; then one third of the other half, and still no symptom. Still another third of either half may be destroyed without any indication of ill health. There are hundreds of the first named cases. With reference to the location of intelligence in the brain, the lecturer said that most physiologists are agreed that it exists in the gray matter of the upper parts of the organ. There is no case on record where the gray matter on both sides of the brain has been destroyed without the loss of intelligence, and we must regard that gray matter as the seat of the intelligence. But vast portions may be removed before the loss of intelligence becomes apparent. This the speaker had tested and proved by vivisection of the lower animals.

By the application of galvanism to certain parts of the brain, Dr. Ferrier has produced certain movements. This would seem to prove that there are in the brain certain centers of movement governing certain parts. But this is only a semblance. It is perfectly well known that the cutting away of a large portion of the brain does not produce the least alteration of voluntary movement anywhere. We now know that only a few fibers are necessary to make the connection between the spinal column and the brain. The brain, like the rest of the body, receives nerve fibers coming from other nervous centers, some along the blood vessels, for there are a great number of fibers starting along the blood vessels and going into the cellular tissue of the brain; some fibers coming from the sympathetic nerve; others coming from various sources. We find, for instance, that the prick of an exceedingly fine needle at the *crux cerebelli* will produce rotary movements, the animal whirling around with a rapidity impossible in a normal condition. The activity of the heart may be stopped by the prick of a needle point; convulsions may be similarly stopped by the action of carbonic acid on the mucous membrane of the throat. With these facts under consideration, we may see the vast field of research that yet lies before us, the mere questions arising from the activity of nerve cells affording an almost boundless subject for inquiry. But it is evident that we cannot locate the centers of either sensation or motion in specific parts of the nervous system.

Professor Simon Newcomb gave a description of the proceedings to be taken by the United States in observing

THE TRANSIT OF VENUS

next December. After referring to the various methods of observation and the difficulties pertaining to them, he said that, about two years ago, circulars were sent to American consuls in almost every part of the world where the transit is visible, to ascertain the condition of the weather at those points in November and December, and every other source of similar information was utilized.

The only satisfactory station in the southern hemisphere, in respect to weather, was found to be Hobart Town, in Tasmania. But from all the other proposed southern stations the accounts were very bad, notably at the proposed station at Hurd's Islands; the chances of observation there did not exceed two tenths. The most favorable station left at the south was Kerguelen Island, and that was selected. A party will also be landed, if practicable, at Croisette. Instead of sending four parties to each hemisphere, we shall send three to the north and five to the south, to equalize the chances as to weather. It is hoped to get complete results from two parties in each hemisphere.

To each party there are detailed two officers from the Observatory, two from the Coast Survey, one from the navy, and two civilians. Professors Hall and Harkness go to Hobart Town. Among them are the celebrated astronomers Professors Watson of Ann Arbor, Mich., and Peters of Clinton, N. Y. The constitution of each party is such that in case of disability on the part of its chief, the second officer can take his place. Each party will have three photographers—a chief photographer, who must have been of long experience in the business, an assistant who has had practice, and a second assistant trained only for the occasion. Nearly all the second assistants' positions have been filled by students or graduates of various schools and technological colleges throughout the country. The parties for the southern station will sail, we expect, about June 1. These are all ready; the photographers are to be in full practice here next week. The northern parties will go later and not all together. The Navy Department has furnished a ship, the Swatara, to go to the southern stations. The longitudes of the stations will be determined by occultations wherever telegraph communication is impracticable; but already there is such communication between Vladivostok and Hobart Town. Arrangements are made with the governments for exchanging longitude signals, and the prospect of the extension of cables to New Zealand and other points gives fair hope that there will be only a few points where occultations will be the sole resort

Major J. W. Powell read a paper on the

COLORADO CAÑONS,

giving an account of the progress made in the survey of the Colorado river and its tributaries, under direction of the Smithsonian Institution. Among other wonderful natural phenomena is the Grand Cañon, the most profound chasm known on the globe. Were a hundred mountains, each as large as Mount Washington, plucked up by the roots to the level of the sea and tumbled into the gorge, they would not fill it.

Perhaps the most wonderful of the topographic features of this country are the lines of cliffs, escarpments of rock separating upper from lower regions by bold, often vertical and impassable barriers, hundreds or thousands of feet high and scores or hundreds of miles in length.

Floats for Ships' Boats.

The marine department of the London Board of Trade have been making experiments with the boats of coasters, and find that any old boat can be converted into an efficient lifeboat by using air casings outside. The marine department have for this purpose used air cylinders, which they have specially designed, fastened outside the boat by a netting; so that the boat can be used for an ordinary boat as long as wanted, and converted into a lifeboat when occasion requires it. The material used for these cylinders, and approved by the marine department, is a combination known as "Clarkson's." It consists of a layer of cork about a quarter of an inch thick between two layers of strong canvas. One cubic foot of air space in these cylinders will support about 60 lbs. The cylinders of this material are the cheapest, most efficient, and most durable means yet invented for converting an old boat into a lifeboat. Mr. Clarkson has made the experimental cylinders on models furnished to him by the marine department, and is, we believe, prepared to supply any number demanded. Air cases to place inside lifeboats, also made of this material, have been supplied to some of the mail steamers, and are much preferred by the marine department to cases of copper, iron, zinc, or wood, as they are practically indestructible, are not affected by heat, and are very light.—*Nautical Magazine.*

Lemons Wholesome.

When people feel the need of an acid, if they would let vinegar alone, and use lemons or apples, they would feel as well satisfied, and receive no injury. A suggestion may not come amiss as to a good plan, when lemons are cheap in the market, to make good lemon sirup. Press your hand on the lemon, and roll it back and forth briskly on the table to make it squeeze more easily; then press the juice into a bowl or tumbler—never into a tin; strain out all the seeds, as they give a bad taste. Remove all the pulp from the peels, and boil in water—a pint for a dozen pulps—to extract the acid. A few minutes boiling is enough; then strain the water with the juice of the lemons; put a pound of white sugar to a pint of the juice; boil ten minutes, bottle it, and your lemonade is ready. Put a tablespoonful or two of this lemon sirup in a glass of water, and have a cooling, healthful drink.

THE WHITMORE TURBINE WHEEL.

The essential feature of the invention represented in the annexed engravings consists in the arrangement of the gates, which are placed in pairs on opposite sides of the wheel, and so controlled that the pairs open successively. This construction is claimed to be much more advantageous than that in which all the gates are worked simultaneously to present larger or smaller apertures, because an equal force is at once applied to both sides of the wheel at the same angle, derived from the power of a solid body of water of the full dimension of the gate opened.

The guides are secured in the usual manner between the plates. The pivot bolts of the gates, A, Fig. 1, pass up through the upper plate and have attached to them adjustable levers, B, Fig. 3, by means of set screws, as shown. The ends of the levers, B, are provided with friction rollers which enter slots or cam grooves, C, in the under side of the cam wheel, D. The arrangement of these cam slots is such that, by turning the wheel, D, by means of the rack and pinion represented, the gates numbered 1 (Fig. 3), on the opposite sides of the wheel, will be first opened, and pairs 2, 3, and 4 will follow successively.

In Fig. 2, the wheel is represented without the casing, and, as will be seen, is made in the form of a cone. This shape, it is claimed, adds to the strength and secures the best possible natural discharge, as it obviates downward pressure.

The manufacturers inform us that the apparatus is in successful operation in many localities. They state that they find that a 30 inch wheel, under a 14 foot head, uses, with all gates open, about 100 inches of water, but that with the gates half closed, requiring but 50 inches of water, the same speed is obtained, sufficient to operate a run of burrs and the machinery of a grist mill. The object of the large wheel is to use the water down to a head of 7 or 8 feet in case of drouth; and in the instance where it has been applied, it is stated that three bushels more of grain, per hour, are ground than was formerly done with the overshot wheel, for which the Whitmore turbine was substituted.

The gates may be readily adjusted in case of leakage; and in event of one becoming obstructed, the rest may be closed until the difficulty can be removed. The wheel is built as represented in our engraving in sizes under 10 inches; above this, the difference lies in the position of the set screw, which is arranged in the gate instead of in the levers, B. Each turbine, we are informed, is carefully constructed of the best materials, under the immediate supervision of the inventor, Mr. Titus Whitmore. For further particulars address the manufacturers, Messrs. N. A. Beebe & Co., Waterloo, Iowa.

Fig.2

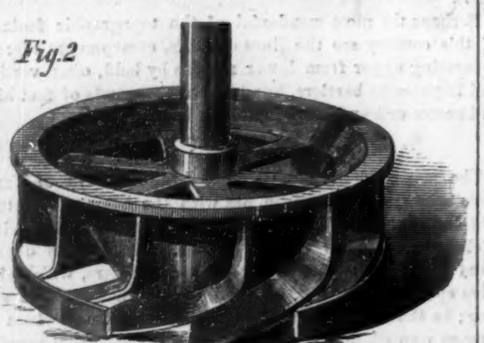
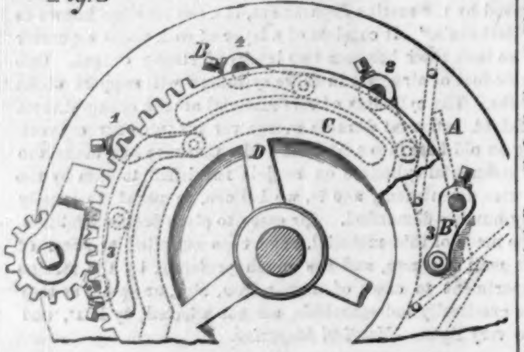
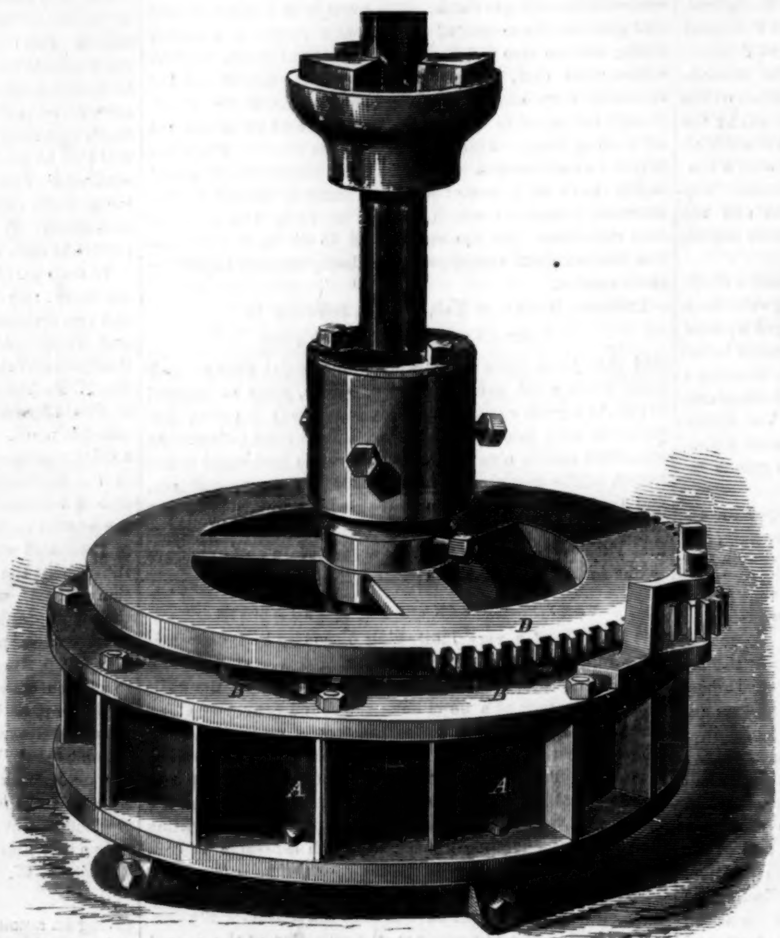


Fig.3





THE WHITMORE TURBINE WHEEL.

Underground Telegraph Lines.

Mr. George B. Prescott states that the system of underground lines in England is both extensive and well constructed, embracing 3,000 miles of wire and nearly 100 miles of iron piping.

The conductors usually employed for underground lines consist of No. 18 copper wire, covered with gutta percha to the gage of No. 7. In order to keep the gutta percha from the atmosphere, the exposure to which would cause it to crack and decay, and thus destroy the insulation, it is tarred and then covered with linen tape and tarred again. The preparation of tar through which the gutta percha and taped wire is drawn, is composed of one quart of raw linseed oil to two gallons of Stockholm tar, and is applied warm.

The wires, when thus prepared, are cut into lengths of four hundred yards, and as many as are required to be laid in one tube are made into a loose cable, and tied together with tape at distances of six feet apart. When the wires are drawn into the tubes the tapes are removed and the wires permitted to lay loosely in the pipes.

The tubes into which the wires are drawn are cast iron socket pipes of two, three, and four inches diameter—the size employed depending upon the number of wires to be laid down, the two inch pipe holding 25 wires; the three inch, 70 wires; and the four inch, 120 wires. The pipes are laid down under the flagstones at an average depth of twenty inches, and the joints are filled with lead.

The cost of laying down three inch cast iron socket pipe for underground wires is 90 cents per yard, or $1,650 per mile. This includes the cost of the pipe and jointing with lead, the taking up of the pavement, putting the pipe in place and re-paving.

The cost per wire for drawing in the pipes depends somewhat upon the number of wires. The average cost of putting 60 wires in a pipe, including jointing and all other incidental work, is $280 per mile.

The cost of conducting wire for underground lines, consisting of copper wire of No. 18 gage, covered with gutta percha to No. 7 gage, taped and tarred, is $85 per mile.

The total cost per mile for sixty underground wires is $7,030, or $117.06 per mile of wire.

The underground system in England gives comparatively little trouble, and is more favorably regarded than the overhouse plan, the great defect in which is imperfect insulation.

For tunnels, copper wires, insulated with gutta percha, and then tarred, taped, and again tarred, are laid in a wooden trough and attached to the wall. The trough has a cover, coated with zinc, and fastened with tie wire, instead of nails, to prevent injury to the wires.

In addition to the underground lines in the large towns, several others have been laid down between London and the chief commercial and manufacturing towns in England.

Utilization of Certain Offal.

Professor A. H Church, in a paper published in the transactions of one of our agricultural societies, refers to certain waste refuse matters, for the purpose of showing the economical products that may be obtained from them. According to this, fresh blood contains 3 per cent potential ammonia, 5 per cent potash, and 1 per cent phosphoric acid. Dry blood is five times as rich. Blood may be utilized as a manure by mixing with dry peat, or by coagulation with 3 per cent of quicklime, and then drying. Flesh, fish, hair, and wool are best prepared for manure by heating with steam under pressure. Horn, when gently roasted, may be powdered. Glue refuse is a slimy matter, containing in the fresh state 1·75 per cent nitrogen, and when dry 3·8 per cent. "Trotter-scutch," a refuse of skin and hair from tanneries, is a cheap manure, containing in the fresh state 3·58 to 7·60 per cent of potential ammonia.

Refuse hops from breweries contain when fresh 1·91, and when dry, 4·20 per cent potential ammonia. They are best added to compost heaps. The deposits from fermenting liquors are always highly nitrogenous. Sugar boilers' scum contains both nitrogen and phosphates; the scum from beet root sirups appears the most nitrogenous, containing when dry 4·6 per cent potential ammonia. The liquors obtained by "retting" flax and hemp are nitrogenous, the solid contents yielding 2·7 to 4·0 per cent potential ammonia.

GARDNER'S IMPROVED WHEEL.

The novel form of vehicle wheel represented in our engravings is so constructed that, when broken or injured, any part may be easily removed and replaced, or the entire device may be taken apart and packed for shipping or other purposes. By suitable means below described, shocks and jars are, it is claimed, prevented from coming upon the spokes; and in fine, while a lighter and more graceful appearance is given to the wheel, its durability is considerably increased.

Fig. 1 is a perspective view of the device. Between the outer tyre and the inner and stronger tyre of iron, is placed a felly, A, of wood, india rubber, or similar elastic material, in order to form a cushion between the rims, and thus to relieve the spokes from shock. The latter are fastened by their outer screw ends into the inner rim, or may be driven into sockets on the same. Their inner ends are socketed in the hub, which is constructed of three sections (Fig. 2) or rings, one central, B, and two outer ones, C. The central ring, Fig. 3, is provided at both sides with semicircular grooves, of which those on one side are placed intermediately between those of the other side, so that one half the spokes may be socketed on either face. The outer rings, C, are provided with semicircular grooves corresponding exactly to those of the central ring, embracing thereby the spokes, and giving to them a firm support. All the rings are placed upon a box, D, and are firmly bound together by the screw nuts, E.

The hub is placed over the axle and protected against the entering of dust by suitable clasps or covering. Any injured portion of the wheel may be taken out and a new piece replaced by detaching the screw nut, E, the balance of the wheel remaining unharmed, being thus rendered still useful.

For military purposes, for mounting artillery, it would seem that this wheel is especially suitable. There is no shrinking or swelling, we are informed, and the heaviness and strength may be increased or diminished by suitable construction, as circumstances may demand.

Fig.1

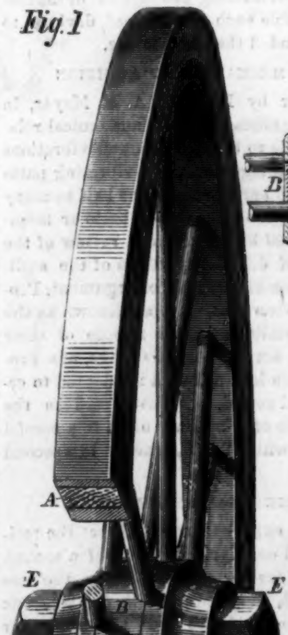


Fig.2

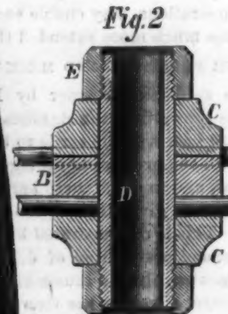


Fig.3

Patented through the Scientific American Patent Agency, March 24, 1874. For further particulars address the inventor, Mr. Stephen C. Gardner, Eagleville, Tolland county, Conn.

PRIZE FOR AN ESSAY ON STEEL.—The Academy of Sciences of Berlin offers a prize of $200, payable in July, 1876, for the best essay recording experiments as to whether changes in the hardness and friability of steel are due to chemical or physical causes, or to both. Papers, in German, Latin, English or French, are to be sent in before March, 1876.

CREMATION FURNACE.

We alluded last week to the subject of cremation, and in the course of our article briefly referred to Professor Brunetti's process for reducing the body to ashes. The large engraving, which we present herewith, represents the plan devised by Sir Henry Thompson, of London, which has been practically tested under the personal superintendence of that eminent gentleman. A cylindrical vessel, some seven feet long by five feet in width, is arranged in connection with a furnace, so as to be heated to about 2,000° Fah. The inner surface of the cylinder is smooth, almost polished, and nothing is visible in the receptacle but a pure almost white interior, the lining being raised to a white heat. The body, in a metal coffin, is laid upon a lattice work of fire brick, and the doors being closed, the process continues for about fifty-five minutes, reducing the body to a mass of white ashes some five pounds in weight. It is proposed to construct a cremation house, large enough to contain two or three halls and, separated from them, several powerful furnaces of the above mentioned description. The mourners are intended to assemble in an adjacent hall, where the usual funeral ceremonies could be conducted during the incineration, after which the ashes, inclosed in a suitable urn, would be taken away by the relatives of the deceased.

There is one drawback to cremation which the opponents of the process will not hesitate to bring forward in the strongest terms. We allude to the impossibility of detecting evidences of poisoning, now found by post mortem examination, in case such investigation be deferred until after burning. As a necessary result, the opening of every body and examination of the vital portions would probably follow; but this would involve considerable expense, beside arousing the powerful opposition of the relatives of the deceased. It is very questionable whether the majority of mankind would be induced to consent first to the mutilation of the remains of those nearest to them, and then to their subsequent destruction by fire. The impossibility of otherwise proving the existence of foul play would be apt to lead to crime.

The Cremation Society, which has recently been incorporated in this State, has held a meeting and adopted a basis of organization. It binds itself to perform the act of cremation on the remains of any shareholder, provided he or she shall express such a desire before death, and in case of no opposition from immediate relatives. The strictest measures will be taken to prevent the cremation of any person who has come to his death by any other than natural causes, and the process will be furnished at as near cost as possible. It is believed that the expense will be about from \$5 to \$8 for each body, and the company propose to erect buildings and furnaces, at a cost of \$10,000, in the suburbs of the city. The ashes will be at the disposal of friends or relatives, who may choose to bury or inurn them. At the recent meeting, Professor Barnard, Professor Seely, and other eminent gentlemen delivered addresses in favor of the system.

There is little doubt but that this movement is exciting an increasing degree of popular attention. There is a sort of morbid fascination about it akin to that which causes a person to read and calmly discuss the horrors of the dissecting room, from which, were they palpably presented to him, he would recoil in disgust and dismay. Cremation will doubtless bring forth a multitude of inventions, in the way of furnaces, urns, and similar paraphernalia, and perhaps corpse cremation companies will, in time, appear with patented processes for incinerating us in the quickest and cheapest manner. At present, however, the movement looks very like a grand sensation—to be talked about and argued—but to be scouted, we fear, when its actual practice is brought home to the masses.

The Hardness of Minerals and Metals.

In physics, one body is said to be harder than another when it is capable of scratching the specimen with which it is compared. In mineralogy, in which science the hardness is an important characteristic, ten bodies are usually taken as points of comparison—the softest being termed 1 and the hardest 10. These are: 1, talc; 2, gypsum; 3, carbonate of lime; 4, fluor spar; 5, phosphate of lime; 6, felspar; 7, quartz; 8, topaz; 9, corundum; 10, diamond. Hence, when scientific works speak of the hardness of a body being 6, 8, 4, etc., reference is made to the relative hardness expressed by the list above given.

The tenacity of metals is estimated by the resistance which wires of the same diameter experience when passed at equal temperature through the same hole of a draw bench. The following table gives the relative tenacity of various metals and alloys: Steel already drawn, 100; iron already drawn, 88; brass already drawn, 77; gold at 0·875, annealed, 73; steel annealed, 65; copper already drawn, 68; silver at 0·750, annealed, 58; silver at 0·875, 54; brass annealed, 46; iron annealed, 42; platinum annealed 38; copper annealed, 38; fine gold annealed, 37; fine silver annealed, 37; zinc, 34; tin, 11; lead, 4.

Sensitive Photo Paper.

Sensitive photo paper, which will keep for a considerable time without deterioration in any respect, is made by Mr. H. T. Anthony, of this city, as follows:

To thirty grains of nitrate of silver in an ounce of water, add two grains of citric acid. After this is dissolved, add ammonia until precipitation ceases. Then re-dissolve with nitric acid, and leave the solution so that a small proportion of the precipitated citrate of silver remains. Let that settle perfectly, and then add ten drops of nitric acid to every two quarts of solution. Sheets of the ordinary albuminized paper may be sensitized by floating for a minute and a half. No trouble from bubbles. The paper is more sensitive in printing than the ordinary paper, and tones splendidly. The paper is fumed in the usual way with strong ammonia. Paper made in this way will be found just as white at the end of five days as when first prepared.

Moritz Hermann von Jacobi.

We regret to hear of the death of this eminent scientist, which took place on March 10, at St. Petersburgh, Russia. He was born at Potsdam, Prussia; but his life was mainly spent in Russia, where his many important discoveries in the application of galvano-electricity to industrial purposes were made. He constructed a short line of telegraph in St. Petersburgh in 1830, and ten years afterward his book, entitled *Die Galvanoplastik*, was published. He was for a long time associated with Klein in the investigation of the electro-deposition of iron, already described in these columns; and he suggested to the Czar Nicholas the formation of a regiment of galvanic engineers, to be trained in the management of electricity. This idea was carried out, and the learned doctor was made colonel of the galvanic regiment.

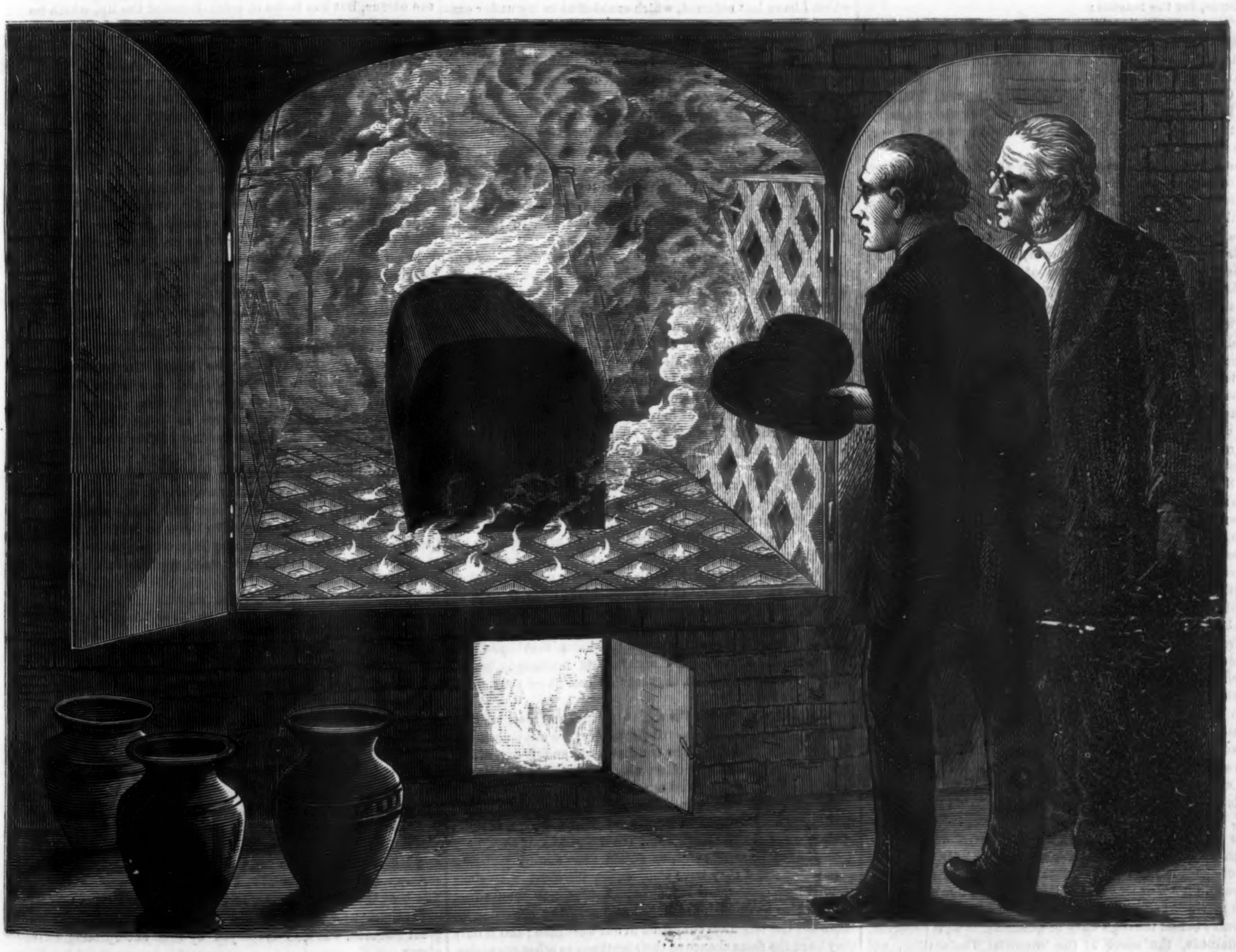
He constructed in 1834 the first electro-magnetic engine that was anything more than a model, and in 1838 he used it to propel a boat containing ten or twelve persons on the Neva. She was fitted with paddle wheels, and a speed of four miles an hour was maintained for several days. The power was supplied by a battery on the Grove principle, of 64 platinum plates, each having 36 square inches of surface.

His labors were highly appreciated in Russia, and were rewarded by many marks of imperial favor as well as by wide popularity.

A Simple Insect Catching Device.

A writer in *Les Mondes* says that he is enabled to materially reduce the number of insects which prey upon the flowers and fruits of his garden, by covering the inside of an old tub with liquid tar, and at twilight putting a lighted lantern within, leaving the whole out over night. The bugs, attracted by the light, try to reach the lantern and are caught and held fast by the tar.

DOGS AS SMUGGLERS.—Large dogs, bred and trained for the purpose, are taken across the Belgian and Swiss frontiers and are dispatched to French territory, under cover of the night, laden with tobacco and other colonial produce on which a high duty is leviable in France.



THOMPSON'S METHOD OF CREMATION.

THE CENTENNIAL EXHIBITION.

To the People of the State of New York:

It is right that the people of the United States should know that the day and year which closed the century of American Independence—July 4, 1876—will be commemorated with ceremonies expressive of the gratitude and pride of a great nation; and, in accordance with the act of Congress of June 1, 1872, which created the Board of Finance, the following report is made over the signature of the President of the board:

The original law of Congress, enacted March 3, 1871, provided for "the celebration of the Centennial of American Independence by an international exhibition of the arts, manufactures, and natural resources of this and other countries, under the auspices of the government of the United States."

And the act of June 1, 1872, fixed the capital to complete this great commemoration at $10,000,000, which was by the Commissioners apportioned among the several States and Territories on the basis of population.

Of this sum the State of Pennsylvania alone, aided by a subscription of $100,000 from the State of New Jersey, has raised, in the form of subscriptions to the stock and by appropriations from its Legislature and the Councils of Philadelphia, about $4,000,000, or nearly one half the amount necessary to insure success. This provision having been made, designs for suitable buildings were approved, and other preliminary and incidental arrangements have so far advanced as to justify an immediate commencement of the work of construction.

The Commissioners have appealed to the Congress of the United States, on the basis of these subscriptions, appropriations, and preparations, to maintain the spirit of the two laws above referred to, and the correspondence of the State department with foreign powers has induced the governments of the Netherlands, Belgium, Switzerland, Germany, Sweden, Liberia, Ecuador, the Argentine Confederation, Chili, Mexico, Hayti, and the Sandwich Islands, to express their intention to participate, and they have every reason to believe that this appeal to Congress will be generously responded to.

Subscriptions to the stock have also been made by individuals in the States and Territories of Missouri, Illinois, Nebraska, Montana, Indiana, Nevada, Oregon, California, Louisiana, Florida, Maryland, Ohio, Wisconsin, Michigan, Arizona, New Jersey, Delaware, Rhode Island, Arkansas, Alabama, New York, Virginia, Iowa, and Kansas.

Such in brief is the condition of the organization for the international commemoration of the close of the century of American Independence.

The city of Philadelphia was selected as the most fitting locality at which to celebrate the birth of American Independence, for the reasons:

1. That from Philadelphia the Magna Charta of human liberty, the immortal Declaration was uttered. The buildings in which the convention sat remain substantially as they were on that day; and

2. Of all the points of revolutionary interest, Philadelphia is the most central and accessible to the whole country. It is the Republic's celebration of its birthday at the very place of its birth.

The Finance Board earnestly urge their fellow countrymen to keep in mind the great fact that the event to be commemorated is the grandest and most momentous in history, that the commemoration is to take the form of an exhibition of the stupendous progress made by the American people in the first hundred years of their independence, in everything relating to the natural resources of the country and their development, and especially its progress in those industries, arts, and institutions which benefit mankind.

How diversified are the objects which must enter into that exhibition—how vast the buildings and the space required to present them with full effect—are suggestions that need only to be mentioned to bring home to every American the colossal magnitude of the undertaking.

Consider for a moment the industries, products, and devices necessary to an adequate expression of the progress of your own State, and the space that will be essential to their full presentation, and you can hardly fail to perceive that your State alone will require an area in the exhibition buildings and grounds equal to that occupied at Vienna by England or France. This is true of not less than ten of the older States. The other twenty-seven States and ten Territories will each of them require space in proportion.

That the stock of the Centennial Board of Finance might be within the reach of every citizen, the Congress of the United States fixed every share at $10, which will be represented by a handsome steel engraved certificate, executed by the Treasury Department of the Government, and fittingly designed in commemoration of the event. The board in soliciting subscriptions to its stock feels assured that there is a patriotic desire to render the exhibition worthy of the occasion.

Notice is hereby given that checks and drafts can be addressed to the Financial Treasurer, Frederick Fraley, No. 904 Walnut street, Philadelphia, for any number of shares at $10 each, and certificates of stock will be promptly returned. The International Exhibition will commence on the 19th of April, 1876, and close on the 19th of October, 1876.

The undersigned, President of the Board of Finance, speaking for his colleagues, and, he believes, for the great body of the American people, does not doubt the answer of that people to this earnest appeal. They are not unmindful of the patriotic interest in the Centennial of their own independence, nor of the high duty of honoring it as it deserves. Philadelphia, the scene of the immortal Declaration, not only in the old hall where it was written, and whence it was proclaimed, but in the extensive park where the exhibition is to be held, sacred as the resort of Washington and the revolutionary worthies, has given many times her share to the memorial. It is not her celebration—it is the nation's. History has simply designated that city as the spot where the national sentiment can be historically expressed.

Every other city and State is inspired by the same sentiment. Every man and woman, North and South, is stirred by the same impulse. All the peoples of the earth are earnest spectators and students of our progress. The work, therefore, is at once national and international. It reaches every class and every interest. It will be the most remarkable comparison and interchange of ideas and inventions, of art and science, of the products of the earth, the brain, and the hands—the most friendly and complete intercourse between the races of all countries in modern civilization. It is impossible to believe that any portion of the American people will hesitate to unite in what is a sacred memory and a sacred obligation. JOHN WELSH,

President of the Centennial Board of Finance.

The March of Improvements.

The twenty-first anniversary of the London Association of Foremen Engineers and Draftsmen was held in that city, March 14, Thomas Brassey, M. P., in the chair. A large number of distinguished men, engineers and others, members of the Association, were present. Sir Edward Belcher responded for the navy. Among other things he expressed the belief that every captain who commands an ironclad ought to be a thorough engineer, otherwise he cannot perform his duty as he ought to be able to do in such a ship, propelled by steam power.

Mr. Joseph D'A. Samuda, M. P., responded for the House of Common. He said:

At this moment I am only just reaching my sixtieth year, and yet I can recollect a series of improvements effected in my time which probably exceed in importance all the improvements witnessed for 600 years previously. I remember the first steamboat which ever plied between the Tower and Ramsgate; I remember when a boy going down to see it start from the Tower Stairs. I remember the rise of almost every great marine engineering establishment, and notably I remember the first marine engine ever made by a firm now of worldwide reputation—that of Messrs. John Penn and Sons. I remember the first railroad ever used on our shores for the conveyance of passengers. I remember the first introduction of telegraphy, which has so completely united together in one family the whole of these islands that you would scarcely believe that any distance separated the most remote and the nearest customers with whom we have to deal. I remember still more the culminating point of that particular science to which I have last referred, which enabled us to lay under contribution nations—no matter how distant—by passing under the broadest ocean the means of communicating with India and America, in about as brief a space of time as we can with our nearest neighbors. All these circumstances have tended to developed that great industry the heads of which are represented here on this occasion—I mean engineering in a general comprehensive sense. It is to those great inventions which have so startled the world that we owe so much; and yet I am convinced that they have not reached their maturity, but are only on the road to increased triumphs. How important then becomes a Society like yours, which must exercise a rapidly extending influence on the future of engineering for generations to come!

Mr. Brassey said:—Well, I know when I address a body of foremen engineers that I am speaking to one of the most intelligent classes in this country—to a class of persons who have contributed, perhaps more than any other, to establish the fame and reputation of our country. In whatever direction you look, you see monuments of their skill, their character, and their ability. The electric telegraph, the steam engine, the loom of Mr. Arkwright, and other improvements, are English inventions which have been the means of revolutionizing several great departments of industry to which the labor and ingenuity of man are applied, and which have established the claim of England to the pre-eminence as an engineering country. Speaking for myself as one owing so much to the invention of railways, I think I ought to be, and I assure you that I am, full of appreciation of the mechanical genius of my countrymen. While referring to railways, I would, before leaving that subject, just remark that, great and important as have been the inventions connected with the railway system up to the present period, we are still greatly needing a further development of ingenuity in order to make traveling by railways as safe as we must anxiously desire to render it. And speaking as a railway director, I can say to you, who, I am sure, very many of you, possess great capacities for invention, that if you can only discover a thoroughly satisfactory continuous brake, you will confer an almost unspeakable benefit on your countrymen.

I feel that, although at the present moment we are possessed of great eminence in engineering industry, we are threatened daily with great competition from abroad, and I am afraid that the competition may come, not, as we readily anticipate, from Germany, France, and other old countries of the world which command a cheaper supply of labor than we do, but possibly it may come from the United States, where, in spite of their most costly labor, they have the means, if they only properly adjust their tariff, to obtain raw materials better than we do; and they have also shown the most marvelous facilities for mechanical invention. Let us not then suffer ourselves to be outstripped in the race—let due provision be made for the technical education of our workmen; and if only they have the same chance as their brethren in other countries, then I have no fear of their holding their own. I hope for a great deal of aid from the Government in the direction I have ventured to indicate; but I also feel that we in England have very rightly sustained the principle of self help as one of the most considerable of our national virtues; and I find in the existence of your institution, which is intended to contribute something towarl the technical education of our engineers, a manifestation of the noble principle of self-helpfulness.

The Works at Creusot.

It is refreshing, in the midst of the financial difficulties of France, and considering the unsatisfactory state of trade, to hear of the continuous growth of the works of the Schneider Society at Creusot.

The surface now covered by shops and other buildings belonging to the works exceeds 50 acres, and the entire area of the property, including mines, is 440 acres; the length of rail laid down at and from the works is 53 miles, of which two thirds are double ways; the number of workmen employed is 10,000; the steam engines are 234 in number, and of 12,700 horse power. The production amounts to 190,000 tuns of coal; 180,000 tuns of pig iron; 90,000 tuns of wrought iron; 60,000 tuns of steel; value of the locomotives built, 100 per annum, $1,400,000; and that of other machinery, with bridges, $1,200,000.

The new works and extensions lately carried out and in contemplation consist, first, of providing an additional water supply. M. Droillard, who carried out the former waterworks, has planned others to bring the waters of a stream called the Rançon to Creusot. The supply required at Creusot is a volume of 4,000 tuns, and the Rançon is calculated to supply that quantity in the driest season.

The main conduit will be more than twelve miles in length, and has been planned to deliver 10,000 tuns at high water. It will be formed of cement, wherever the contours of the ground permit; but when the pressure surpasses fifteen or twenty meters, cast iron pipes will be substituted.

New Treatment of Cancer.

Another treatment of cancer has been brought out by Dr. Hasse, of Berlin. An account of it is given in the *Medicinische Central Zeitung*, February 18. Dr. Hasse injects, with a hypodermic syringe, pure alcohol, to which one per cent of ether is added, not into the new growth, but around its edges, thus obliterating, he claims, the vessels, especially lymphatics, which convey the infection, and causing the atrophy of the growth itself. The pain is rather severe, but is much reduced by ice bags, and lasts only about two hours. The injections are repeated every eight to fourteen days, and have no alarming reactions. He claims striking success in carcinoma of the mamma, and in cauliflower excrescence of the uterus, but has failed in epithelioma of the lip, which he attributes to the impossibility of obliterating by this means the large and closely adjacent coronary artery.—*Medical and Surgical Reporter.*

New Railway Signal.

MM. Lartique and Laforest have recently invented a novel device, intended as a danger signal, which the *Revue Industrielle* states is now in successful use on some of the French railroads. A whistle is arranged on the locomotive so that it will, when once opened, continue sounding until shut by the engineer. The same device which turns the disk signal, so as to show the danger side, is extended to transmit a current of electricity to a little projection between the rails. When the engine passes over this spot, a metallic brush hanging between its wheels strikes on the projection and sweeps over it, at the same time transmitting the current to an electro-magnet which pulls the whistle open. The latter, by continuously sounding, warns the engineer.

Industrial Exhibition of the Franklin Institute.

The Franklin Institute of Philadelphia announces the celebration of the fiftieth anniversary of its foundation by an exhibition of arts and manufactures, to be held in the above mentioned city from the 6th to the 31st of October next. The plan is to secure as full a representation as possible of the mechanical improvements of the last half century, and all artisans, mechanics, manufacturers, and inventors are invited to contribute their best productions and to compete for the prizes which will be awarded to the most worthy. Facilities will be afforded for machinery in motion. All desiring to exhibit are requested to make early application for space, power, etc.

Mountain and Lake Surveys in New York.—A New Canvas Boat.

Mr. Verplank Colvin has recently submitted to the legislature of New York State his report for the past year of surveying operations in connection with the Adirondack mountain regions. Among other results he corrects the hights of several of the mountain peaks. Mounts Marcy and McIntyre, he finds, are correctly given at 5,000 feet altitude. He reduces Mount Dix to 4,879 feet, Mount Seward to 4,348 feet, and Santanoni to 4,607 feet. He finds Mount Haystack and Mount Skylight to be higher than heretofore reported, and gives new measures of several other mountains of important altitude.

Mr. Colvin also gives the measures of some two hundred new lakes, covering from forty to fifty square miles. He describes a novel portable boat used by him upon these lakes. The boat is made of canvas, and weighs only 10 pounds 8 ounces. A new signal, of his own invention, visible at a great distance, was also employed by this enterprising explorer.

DECISIONS OF THE COURTS.

United States Circuit Court---Northern District of New York.

HARVESTER PATENT.—MARSH *vs.* THE DODGE AND STEVENSON MANUFACTURING CO.

[In equity.—Before Woodruff, Justice.]

A claim to a result is not, *per se*, patentable; neither can a claim be sustained which covers every mode or means by which certain advantages can be secured in a harvester.

The mere location of an old apparatus upon a machine is not patentable.

If new devices are required in order to adapt an old apparatus to a new position on a machine, and the change produces a new and beneficial result, then the change is patentable in connection with the new devices; not the result, but the means of producing it.

Or if such a change brings into existence a new combination of devices productive of a new and useful result, the new combination is patentable.

The patent will not be infringed in either case by a like change in the location of the apparatus, unless the new devices which adapt it to its new position are also used in one case, and unless all the material elements of the newly developed combination are employed in the other.

In changing the location of an apparatus upon a machine it seems not to be patentable to adopt such mechanical changes to render it practicable as mere judgment dictates or the necessity of the case demands.

Complainant dismissed with costs.

James O. Parker and *D. Wright* for complainant.

George Harding for defendant.

NEW BOOKS AND PUBLICATIONS.

HANDBOOK FOR THE ARTISAN, MECHANIC, AND ENGINEER: comprising the Grinding and Sharpening of Cutting Tools, Abrasive Processes, Lapidary Work, Gem and Glass Engraving, Varnishing and Lackering, Apparatus, Materials, and Processes for Grinding and Polishing, etc. By Oliver Byrne, Civil, Military, and Mechanical Engineer, Author of "The Practical Metal Worker's Assistant," etc. New Edition. Illustrated by 185 Wood Engravings. Price $5. Philadelphia: Henry Carey Baird, 406 Walnut street.

This valuable volume is too well known to need eulogy from our pen, and our appreciation of it is best shown by the frequency with which we have occasion to consult its pages for details of technical processes. The artisan, desirous of learning the art of finishing metal and brass work to the highest perfection, will find it a compendium of the best modern practice both in this country and Europe; and its directions are rendered doubly valuable, for intelligibility and accuracy, by the profusion of excellent engravings with which it is illustrated.

A MANUAL OF EDEOGRAPHY, or the Art of Writing by Sound, being a Complete System of Phonetic Short Hand, adapted to Verbatim Reporting. Philadelphia: T. W. Evans.

This little handbook gives full explanations of an admirable system of stenography, one of the most useful arts which youths can devote their leisure hours to acquire.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 27 to April 6, 1874, inclusive.

BREECH LOADING FIRE ARM.—A. Swingle *et al.*, San Francisco, Cal.
CAR BRAKE AND COUPLING.—H. E. Marchand, Pittsburgh, Pa.
CAR BUFFER AND COUPLING.—W. H. Skidmore, Philadelphia, Pa.
CRUSHING ORE, ETC.—S. R. Krom, New York city.
CULINARY APPARATUS.—J. S. Kidd, Brooklyn, N. Y.
DRESSING MILLSTONES.—D. Larer *et al.*, Pottsville, Pa.
EMBROIDERER.—R. M. Rose, Williamsburgh, N. Y.
HORSE HAY FORK.—J. G. Williams, Fellowship, N. J.
LOOM.—T. W. Harrison *et al.*, Boston, Mass.
MELTING STEEL.—A. C. Lewis, Brooklyn, N. Y.
PAPER TWINE.—J. B. Wortendyke, Godwinville, N. J
PLOW.—W. Donnelly, Calverton, N. Y.
PREPARING FLOUR.—O. F. Cook, Grand Island, Cal.
STEAM ENGINE.—E. Cope *et al.*, Hamilton, Ohio.
STEAM ENGINE.—J. C. Nobles, Elmira, N. Y.
TRANSPORTING CASKS.—W. J. Reid, New York city.

Recent American and Foreign Patents.

Improved Copy Holder.

James B. Harper, St. John, Mo.—This invention relates to copy holders, whereby a newspaper or written sheet or strip may be held before the eyes of a copyist or compositor, and conveniently unrolled as he progresses with his work of transcribing or setting a type copy.

Improved Coffin Plate.

George Brabrook, Taunton, Mass.—This invention relates to a novel and useful construction of coffin plates whereby they may be not only adapted to receive the usual superscription, but also to hold the bouquet which is often placed upon the top of coffins.

Improved Piano Sounding Board.

Frederick Niederheitmann, Aix-la-Chapelle, Prussia.—This invention relates to a novel composition of matter whereby those properties of wood which adapt it to use for the sounding boards of pianos, guitars, and other musical instruments may be preserved for an indefinite period, such prepared sounding boards not only retaining their peculiar quality, but undergoing an actual change for the better.

Improved Mode of Propelling Street Cars.

George S. Grier, Milford, Del.—This invention relates to the well known plan of propelling street cars by means of an endless chain or rope placed below the cars or track, and actuated by friction pulleys, sprocket wheels, or spike wheels, over which it is made to pass. These drive pulleys or wheels are themselves set in motion by steam or other power applied through ordinary connecting mechanism. This mode of propulsion which has heretofore been tried and deemed impracticable is made, by this invention, easy of application and thoroughly effective.

Improved Heating Stove.

William Chelius, Paterson, N. J.—This is an improved heating stove, so constructed as to pass the air to be heated in thin sheets between two metallic surfaces, both of which are heated by the passage of the heated products of combustion, so that the air may be quickly heated, and so that all, or nearly all, the heat may be extracted from the products of combustion before they are allowed to pass off into the chimney.

Improved Middlings Purifier.

George W. Dellinger, Ripon, Wis.—This invention consists in the combination, with the suction fan and case, of the two oscillating sieves, the top one made smaller than the lower one, to allow the upward passage of light particles of matter from the lower sieve. These screens will be self-cleaning, in consequence of the lively action of the flour or middlings on them, and thus the brushes, knockers, etc., used with ordinary middlings cleaners and bolts will not be needed.

Improved Brick Machine.

Peter Harnist, Marine, Ill.—There are two mixing cylinders, which stand side by side, and are operated by means of bevel gears from the cam shaft. The box into which the prepared clay is delivered from the mixing cylinders has a sliding bottom. A stamper is raised twice at each revolution of the cam shaft, and drops by its own gravity, and in so doing compresses the clay in the trough. The sliding bottom is moved to the right and left alternately by means of a cord and working beam, which beam oscillates on a central pin. A ledge on the sliding bottom forces the clay into the molds, and vertical knives descend at the right moment and cut the brick to the proper length. At the next movement of the sliding bottom in that direction the brick is forced from the mold on the transferrer, composed of hinged boards connected by a rod. When the transferrer is full, it is acrried away and deposited on the conveyer

Improved Speaking Tube.

Theodore Niele, Pittsburgh, Pa.—This invention consists of a speaking tube in which is placed at the throat or near the mouth a hinged valve connected by a rod with a weight or knob. The gravity of the latter exerts a constant force through the rod, and tends to keep the valve closed until overcome by a greater counteracting power. By this means the air always finds a ready avenue of escape through the whistle. The indicator is located with respect to the whistle so that it will be actuated simultaneously with the sounding of the alarm, and, being raised, thus exhibit to view the precise tube from which a signal has been given. The opening of the valve, in order to answer the call has the effect of automatically closing the indicator.

Improved Mechanical Movement.

Henry C. Work, Brooklyn, N. Y., assignor to Alanson Work, Providence, R. I.—The object of this invention is to furnish a new combination of wheels for producing a new mechanical movement for the application of steam, or for elevating and forcing water, and for all the purposes for which it may be adapted; and it consists in a disk which rotates on a central axis or arbor, with two gear wheels pivoted thereon eccentrically to the center, which wheels engage or work together, with each an arm attached to the periphery thereof, or connected therewith, which sweep the surface of an irregular scroll cylinder.

Improved Water Wheel.

Dodge P. Blackstone, Berlin, Wis.—This invention relates to improvements in turbines; and consists, first, in forming a flume or free annular passage around the wheel, between its hub and the enclosing stationary part in which the chutes are located; second, in the arrangement of the gates for closing the chutes. The latter are hollowed out on the inner side, leaving only a bearing surface around the edge. They are provided with stems which pass through slots in brackets of the gate-operating frame, and on these stems are placed spiral springs which bear against the brackets, and are adjusted to greater or less tension by nuts. The bracket slots are so formed as to allow the gates considerable play on their seats or bearing surface, and the springs take off the pressure of the head of water, so as to relieve the gates of much of the friction that would otherwise exist.

Improved Apparatus for Pressing Meat Scraps.

Samuel Booth, New York city.—This is a tub for the pressing of meat scraps, having a surrounding jacket enclosing the tub in a space for heating it by steam, with pipes running through it from the orifices for the escape of the fat, and projecting a little beyond the outside of the jacket for discharging the fat into the receiving pan below. The press follower is provided with holes for the escape of some of the fat through it directly from the surface of the scraps, whereon the follower acts. The object of the jacket is to maintain the scraps at the proper degree of heat for obtaining the best results throughout the process of pressing, and thus save considerable loss now sustained, both in the quantity of fat obtained and time consumed, in consequence of the cooling of the scraps after being put into the press.

Improved Hay and Cotton Press.

George Mosteller, Walker, Ga.—This invention relates generally to all kinds of presses for baling cotton, hay, or straw, but more particularly to such as are transported upon wheels to and through the field, thus enabling the crop to be baled without being transferred to the barn.

Improved Machine for Driving Brush Handles.

John Ames, Jr., Lansingburgh, N. Y.—This invention has for its object to improve the construction of the machine for which letters patent No. 142,137 were granted to same inventor August 26, 1873. To the table is attached a frame, in which a plate slides up and down in grooves, being actuated by suitable gearing. Means are provided to limit the downward movement of the plate, and insure the driving of all the handles of all the brushes of the same lot to exactly the same point. To the plate is attached a bracket, to which is secured the driver by which the handle is forced into the brush. In the table directly beneath the driver is formed a hole into which is fitted a thimble to receive and fit exactly upon the ferrule of the brush, and support it against the strain while the handle is being driven. To the lower side of the table, around the hole, is attached a downwardly-projecting tube which is slotted longitudinally, and surrounded by a collar. The latter is made with a bar passing through the slots of the tube, and with a rod upon its center which fits into the cavity of the said slotted tube. The rod is perforated longitudinally, and its upper end is concaved to receive the end of the brush handle, and hold it exactly centered while being driven. From the opposite sides of the collar two cords pass over guide pulleys pivoted to the upper part of the frame, and carry weights. A small rod passes longitudinally through the perforated rod, and its lower part fits into the cavity of the slotted tube when forced upward. To the rod is attached a cross bar, to the ends of which are attached cords which pass over guide pulleys, and also carry weights. A bolt which enters a notch in the side of the rod when pushed down keeps it from being raised by the weights. The bolt is held forward against the rod by a spring. To the outer end of the bolt is attached the lower end of a lever. In the upper end of the rod is formed a socket to receive a steel point, which is designed to force its way and guide the rod through the center of the brush, when the rod is released from the bolt and is forced upward by the weights. In using the machine, the point is inserted in the upper end of the rod, and the said rod is forced downward until caught and held by the bolt. The brush is then inserted in the thimble, and the lever is operated to release the rod, which is forced upward by the weights, forcing the steel point up through the center of the brush. The steel point is then detached; the point of the brush handle is inserted in the socket in the upper end of the rod, and the driver is lowered upon its base, so that by forcing the driver downward the rod will be forced downward, the handle following it through the center of the brush. As the end of the handle passes through the brush, its end is received by the end of the perforated rod, which holds it accurately centered while being driven.

Improved Stock Feeder.

Levi P. Cox, Breckenridge, Mo.—The box in which the corn is placed is formed of slats correspondingly notched and tongued at the ends, so that they cannot slide inward, while they are enclosed by posts so that they cannot slip outward. The table beneath the corn box is extended out on each side, so as to form, with the vertical edge pieces, a feed trough about the corn box. The slats are vertically movable within the posts, and may be held at any desired elevation by pins passing through the posts, and under the lowest slats. In order to render the feed automatic, the lowest slats rest upon metallic rods, whose ends project to a greater or less distance within the trough, and are of a size easy to be handled. These render the lifting of the slats to a higher adjustment very easy by a single person, who raises one corner at a time and fixes a pin thereunder. These rods also are moved by the noses of the animals in the trough, and tend to relieve any choking or stoppage of the flow of corn.

Improved Hand Nail and Bolt Making Tool.

William Franklin White, Orange, Ga.—This invention consists of a couple of steel bars, having a series of round notches in one side, and square ones in the opposite side, of different sizes, said bars being jointed together at one end by a link, which allows the bars to close both their notched sides together, to constitute dies of the notches in which to head nails and bolts. The said bars are held together by handles at the ends opposite the joint, and a dowel pin on one enters a hole in the other near the handled end, to insure the coinciding of the faces. The notches are countersunk on one side to form tapered heads to the nails and bolts, and flush on the other sides to make flat heads. One series is countersunk upon one side of the bars, and the other upon the other side, so that the bars are not unduly weakened on one side, as they otherwise would be. The said bars are made of steel and duly hardened, to sustain the wear incidental to the hammering up of the heads in them.

Improved Electrolytic Apparatus.

Evans Casselberry, St. Louis, Mo., and Nathan H. Edgerton, Philadelphia, Pa.—This invention consists in combining with a suitable tank or tanks, for holding the liquid to be decomposed, electrodes having two or more bifurcated divisions, upon the surface of which the decomposition takes place, increasing with the increase of the said surface until the total trength of the current is utilized.

Improved Shank Laster.

Edwin Campbell, Bath, Me.—This invention relates to the arrangement of levers and springs with the jaws for griping the edge of the uppers, whereby they are caused to take a firm hold, or to release it. One has a long arm projecting from outside, and the other jaw is pivoted to it. At the upper ends is a cam lever for forcing the lever ends together, and a spring is arranged between them to open them, to release the leather after the work is done. A suitable distance from the jaws the arms are fitted on the right and left hand screws, and beyond the screw they have a rod, parallel with the screws, to keep them parallel with each other when straining the leather, said rod being fastened in one arm and fitted to slide in the other. The screw rod has a handle by which to turn it for forcing the jaws to stretch the shank over the last. The arms are arranged to project to the right of the jaws, so that in use they extend along the sole of the last to carry the operating screw and the guide rod out of the way, and permit convenient tacking of the leather.

Improved Station Indicator.

George A. Brown, Locke, N. Y.—This is an improved indicator for indicating the stations along the line of the railroad, so constructed as to adjust itself automatically as the train leaves a station, and exhibit the name of the next station. The endless belt on which the names, distances, etc. are inscribed, is provided with suitable rotary mechanism, and connected with a lever which projects down through the car. This lever has a free movement longitudinally with the track, but cannot move crosswise of the track without rotating the roller in one or the other direction. Suitable means are provided to bring the lever back to a vertical position, should it be moved by its lower end striking an obstruction. Driven into adjacent ties of the track is a rod which may be inclined with respect to the track, and in such a position that the lower end of the lever may strike it and may be moved laterally to rotate the roller. One of the rods is designed to be secured to the track upon each side of the station, so that the indicator may be set as the train leaves the station in either direction.

Improved Clod Crusher.

Harm Feenders, Charles City, Iowa.—The object of this invention is to furnish an improved clod crushing and pulverizing implement by which the ground may be completely broken after sowing, for the purpose of retaining the moisture therein. It consists in the arrangement of a main supporting frame with a series of lateral knives, which are attached at the lower side thereof to step-shaped seats, so that each knife is back of and deeper than the other, and breaks the clods by repeated concussions with the same in connection with sharp projecting edges of the seat parts.

Improved Grain Dryer.

Pardon B. Hunt, Council Bluffs, Iowa.—This invention consists in the arranging of two cylinders so as to form a grain passage in the shape of an inverted cone or funnel, and so that the grain passage will enlarge as the grain swells, and the passage thus continue throughout to preserve the same relative magnitude to the volume of grain.

Improved Pipe Tongs.

Anton Kotzum, New York city.—The object of this invention is to produce a simple and effective pipe tongs, which may be quickly adjusted to pipes of various sizes and firmly retained in the required width. The invention consists of jaws with lever handles of the usual shape, of which one slides upon a pivot in a slot in the other, for adjusting it to the width of the pipes, and is firmly fastened in the required position by a slotted piece of the pivot, guide pin, and clamping screw.

Improved Machine for Pressing Pantaloons.

George F. Pond, Boston, Mass.—This is a machine for use in forming and pressing the bottoms of the legs of pantaloons. The base board is secured to a support, and to the ends are attached two standards, carrying the shaft, to the forward ends of which is attached a plate. The forward edge of the plate is so shaped as to give the proper form to the front of the pantaloon bottoms. Along the plate, and parallel therewith, extends a finger, the rear end of which is bent inward and extends along the inner end of the plate through a slot in the end of the shaft, and its end is pivoted to a lever. The forward end of the lever is notched to receive a pin attached to the forming plate, and which serves as a fulcrum to said lever. By this arrangement the pantaloon bottoms are stretched while being formed and pressed. The finger is held in place, when adjusted, by a set screw passing in through the end of the shaft and pressing against the said finger. The plate is supported, while the bottoms are being pressed, by a stand attached to the end of an arm, the other end of which is pivoted to the base, so that the said stand can be readily swung back when adjusting or forming the bottoms. One end of a spring is secured to the base, and its other end presses against the shaft to hold said shaft and the plate in any position into which it may be adjusted.

Improved Mesquite Screen.

James P. Miller, Ridgeville, Ill.—This invention relates to a self-closing swinging bar or frame having a netting attached, and operated by a weight having a double cord connection with it at the top and bottom. The invention also includes a peculiar arrangement of cranked or bent pivot rods with the bar to which the netting is attached, whereby the bar is supported and the netting kept stretched without supplementary devices.

Improved Harness Makers' Clamp.

Josiah Smith, Southold, N. Y., assignor to himself and Francis C. Landon, of same place.—The jaws are held together by a steel spring, the lower end of which is secured to the stationary lower part of the hinged jaw, and its upper end rests against the outer side of the upper part of the said hinged jaw. The upper part of the hinged jaw is drawn back, to allow the work to be inserted and released, by an arm and strap. To the lower end of the two jaws is attached a horizontal bar or plate for the operator to put his foot upon to hold the clamp erect when in use.

Improved Hook and Clevis.

William Warne, Huntington Mine, Dillonton P. O., Canada.—The feature which distinguishes this hook and clevis from others is the device for preventing accidental separation of the two when they are in use. For this purpose two slots are made through the clevis and near the wrist. On the sides of the hook, near the end, are formed two lugs, which, when the hook is turned in a certain position, will pass readily through the slots, which allows the hook and clevis to be separated.

Improved Bottom Plate for Range Chimneys.

Hamilton C. Garwood, Jersey City, N. J.—This invention consists of a pyramidal or conical elevation of the middle portion of the plate at the bottom of a flue or chimney over a range. There is a large passage at the top either directly into the chimney or into a pipe extending a short distance from the top and discharging into the flue. A valve closes and opens said passage at will, giving a more efficient means of escape for the effluvium, smoke, etc., arising from the cooking on the range below, than is afforded by the ordinary flat plate with a passage in it.

Improved Folding Clothes Horse.

Elias Kimball, New York city.—This invention consists in the jointed brace bars, in combination with the pivoted horizontal and vertical bars of the sections of a clothes horse. In folding the horse, the sections are brought parallel with each other, and the braces of all the sections are raised at the same time, which allows the horse to be folded up. When the sections are opened out, the braces drop, or may be forced down into locking position.

Improved Beehive.

Josiah Barnes and William Barnes, Topeka, Kan.—This invention relates to that class of beehives provided with main and auxiliary honey frames, and consists in a false bottom for the main honey frame attached to a riser; in a sliding and reticulated false bottom; in putting a strip over the slide to prevent waxing of the joint; in a superposed and open-topped case for the auxiliary honey frames, and in a detachable slide between the two sets of honey frames.

Improved Middlings Purifier.

James A. Stewart, Atlanta, Ga.—The middlings are admitted into the upper part of a trunk through a spout, as fast as they fall from the dusting reels. While still in their loose or disintegrated state, and as they fall from one bucket to another of several attached to an endless chain, they are acted upon by the blast of air driven up through the machine.

ANSWERS TO CORRESPONDENTS

J. C.'s query as to a boiler in the shape of a half moon, and E.P. J.'s, as to a vacuum, are incomprehensible.—J. C. H. can remedy the dampness of the walls by using the waterproof glue described on p. 8, vol. 25.—N. V. H. will find directions for gilding picture frames on p. 90, vol. 30.—L. D. is informed that we reprinted the recipe for mending rubber boots on p. 208, vol. 30. Figured fabrics fade in washing because they are not printed in fast colors.—H. H. Jr. will find the needed information as to the weight of flywheels on pp. 177, 288, vol. 28.—R. M. H. will find a description of making ice by means of heat on p. 243, vol. 30.—H. D. O. will find a recipe for aquarium cement on p. 202, vol. 28. Water colors are finely powdered pigments made into cakes with wax.—C. & A. will find full descriptions of nickel plating on pp. 187, 378, vol. 28.

J. W. Z. asks: How can I preserve eggs? A. Eggs may be preserved for any length of time by excluding them from the air. One of the cleanest and easiest methods of doing this is to pack them with the small end downward in clean dry salt in barrels or tubs, and to place them in a cool and dry situation.

G. F. P. asks: 1. Why does paint in Rockport, Texas, change color, white paint turning almost black in patches? A. The effects mentioned are such as would be produced by the presence of sulphuretted hydrogen gas, and it would be well to investigate the sewerage and drainage facilities, and any spots where decaying and putrescible matters might accumulate, in order to determine whether there were any sources of this deleterious gas. 2. Are chromos printed on cloth as well as on paper, and are they not more valuable? Are not the best printed on cloth? A. The best chromos are printed on cloth, which is more durable than paper.

S. V. C. asks: Is aluminum non-magnetic? Would its presence by indicated by a deflection of the needle? A. Aluminum is non-magnetic.

O. A. F. asks: Which kind of prussiate of potash, white or yellow, did H. J. B. use in making his explosive powder? What kind of sugar is necessary? A. The ingredients are yellow prussiate of potash and ordinary white cane sugar. They must be thoroughly mixed together in a dry state.

Q. V. asks: 1. How can I make good silver ink? A. Nitrate of silver, 11 parts; distilled water, 85 parts; powdered gum arabic, 20 parts; carbonate of soda, 22 parts; solution of ammonia, 30 parts. Dissolve the carbonate of soda, and afterwards the gum (by trituration in a mortar) in the water, dissolve the nitrate of silver in the ammonia and add to the carbonate of soda solution. Heat gently to the boiling point; the ink, at first turbid, becomes clear and very dark. 2. What are decarbonized and Damascus steel? A. Damascus steel is steel made from an ore consisting of magnetic oxide of iron and silica, by the use of charcoal furnaces. The name is also applied to imitations of the original Damascus steel. Decarbonized steel is steel from which a portion of the combined carbon has been removed. 3 Is a breech-loading or a muzzle-loading shot gun the safer? A. Both are dangerous in the hands of careless people, and may be safely used with cautious handling.

J. L. S. asks: 1. Where can full and complete information respecting the grinding, polishing, and mounting of specula be obtained? A. We reiterate that Professor Draper's treatise affords the most available information on the construction of specula. John Browning's pamphlet illustrates the method of mounting them. 2. Has Professor Henry Draper improved his processes for the construction of glass specula since the publication of Vol. XIV., 1864, of the Smithsonian contributions for the diffusion of knowledge? A. No. 3. What is the method at present pursued by With, of Hereford, in the construction of silvered glass specula for Browning's telescopes? A. Extra thick glass is used to avoid flexure, and imperfect mirrors are repolished. 4. Of all the methods devised for the construction of specula, which produces the best results in the shortest time? A. The machine for local corrections (Draper, p. 24).

O. C. asks: 1. Why is it that people talk and write so much about the impossibility of the sun being a body of combustible material in a state of intense heat, alleging that, if such were a fact, it would long ere this have been consumed and have left a blank in space? There is no such thing as destructible matter, as this allegation would seem to imply, combustion being nothing more or less than the change of matter from one form to another without destroying one particle of it. A. The sun is really a combustible body, slowly burning, but its condensation supplies more heat. The oxygen and hydrogen, which will in time form the solar oceans, are dissociated by its high temperature. Eruptions throw these gases into the cooler chromosphere, they burn, and, forming water, show us steam lines in the spectroscope. 2. As the attraction of the sun is sufficient to hold all this matter within its limits, how can this destruction of the sun take place? A. A velocity of 380 miles per second is sufficient to carry ejected material clear of the sun's attraction. The observed velocity of projection is 500 miles. Stars, therefore, are in constant interchange of missiles.

J. A. asks: 1. What is the formula for finding the area of a lune when the width of the lune and the respective diameters of the two curves forming the lune are given? A. Draw the chord corresponding to the two arcs of the lune; then multiply half of each arc by its radius, and subtract the least product (the area of the least circular sector) from the greatest. The remainder is the area of the lune. 2. Can you tell me of some of the double stars? A. A few double stars are: *Gamma Leonis*, orange and green yellow; *Delta Corvi*, yellow and purple; *Gamma Virginis*, white and yellow; *Zeta Ursæ Majoris*, white and green; *Iota Bootis*, triple; *Pi Bootis; Epsilon Bootis; Xi Bootis*, orange and purple; *Mu Bootis*, yellow and lilac; *Delta Serpentis*, *Zeta Coronæ*, white and blue: *Epsilon Lyræ*, multiple; *Beta Cygni*, yellow and blue. All double stars, nebulæ, and clusters are marked in Proctor's "Atlas," price $2.50.

N. B. says: 1. I have a 2 inches achromatic object glass of 30 inches focus, with which I wish to construct a telescope. What size of eyepiece, and of what focus, should I use? What power would such a glass have? A. Use a Huyghenian, or negative eyepiece, field lens about half an inch diameter, ¾ inch focus, the eye lens ¼ inch diameter and ¼ inch focus, both lenses plano-convex, plane side next the eye. The eye lens is placed its own focal length within the focus of the field lens, that is, they are half an inch apart. An equivalent single lens would be half the focus of the field lens or ⅜ inch focus; therefore 30 inches ÷ ⅜ inch = 80, the magnifying power of the eyepiece. 2. What is the difference (in construction) between a terrestrial and a celestial eyepiece for a telescope? A. The terrestrial eyepiece is provided with two additional lenses, to erect the image.

H. L. C. asks: Can I make a telescope, of sufficient power to show Jupiter's moons and Saturn's rings, with a double concave lens, 4 inches diameter and of 6 inches focus, and 1 meniscus lens, 4 inches in diameter and of 6 inches focus? I have a double concave lens, 2 inches in diameter and of 8 inches focus, and a meniscus of the same size and focus; they are from a magic lantern. I also have a double concave, ¾ inch in diameter and of 1¼ inches focus, and 1 double concave lens, ½ inch diameter and of 1 inch focus. Would these lenses do better for a telescope or for a microscope? A. Your lenses will not answer, if your description is correct. A tolerable two inch achromatic object glass costs $4.50, and a useful microscope, $6.00. Either would be preferable to a chance combination of cheap lenses.

O. B. asks: 1. What advantage, if any, have the rotary engines over the ordinary piston engine, and why are they not in more general use? What is the principal objection to them? A. We have seen no accounts of thorough tests of rotary engines, and therefore cannot give a decided opinion upon their advantages. 2. Suppose the wheel of a rotary engine to have ¾ of a square inch effective pressure, and its mean distance from center of shaft to be 1¾ inches, it being under continual pressure; how will it compare with a piston engine having the same area of piston and a stroke of 3½ inches under the same amount of pressure, making the same number of revolutions? Would such an engine be worth bothering one's brain over provided that, for cheapness of construction, simplicity, and durability, it will compare favorably with the piston engine now in use? A. If you can build such an engine, it will be worth your while to experiment. 3. How will gas do as a substitute for steam in experimenting on a small scale? A. It is used in several forms of engines.

E. F. M. asks: 1. How can I protect iron which is continually in salt water from dirt and barnacles? I have tried several paints now in market, but find that they all fail to keep the iron or wood free. A. The paint must be constantly renewed. 2. How can pitch or tar be reduced so as to make a paint, to be used cold? A. With turpentine, we believe. 3. How can I reduce copper to the fineness of flour? Can it be done with acids? A. By heating the copper in an atmosphere of hydrogen. 4. Is the *Science Record* composed of the copies of the SCIENTIFIC AMERICAN? A. No. 5. How much will it cost to have 1 year's copy of the SCIENTIFIC AMERICAN bound? A. In one volume, $2; in two volumes, $3.

J. H. P. asks: Can air brakes be applied to a train of cars if the engine is loose, or can they be applied without the power of the engine? A. In some arrangements they can only be applied from the engine; in others, they can be managed on each car, independently of all the rest.

C. A. J. says: I have a cellar about six feet deep that I cannot keep the water out of, and I wish you to tell me how and with what I can cement it to keep it dry. The cellar is dug in stiff red clay, is walled up with brick 9 inch wall, laid in Louisville, Ky., cement; the floor had cement spread upon it an inch thick, with one course of brick laid upon it, and then well grouted with cement. A. The reason the water is forced into your cellar, notwithstanding the extraordinary precautions you have taken to prevent it, is because of the exterior pressure the former is subjected to, in being confined in the clay surrounding their foundations and rising around the house to a head equal to the depth of the cellar. If you remove this pressure and point up the breaks, you are very likely to overcome the difficulty. To do this, excavate a trench outside the walls, down as deep as the foundations will allow without undermining them, and fill in with stone of all sizes up to 18 inches diameter for about 2 feet in depth and 18 inches out from the house; then refill with the earth excavated, taking the precaution to place gravel or small stones against the wall all the way up for a few inches out. Now, from this lower deposit of stone, provide one or more drains leading away from the house and discharging at a lower level. These drains may be also made of stone like the one around the house, and to prevent their being filled up with dirt some straw or carpenter's shavings may be laid over the stones. In this manner the outward pressure may be removed; and if, when the trench is open, a coat of cement be put on the outside of the foundations in addition, then the prospect of a dry cellar may be reasonably indulged.

A. B. F. asks: How many cubic feet of water displacement does the United States government allow per tun for river steamboats, and for sailing vessels? A. About 36 feet.

O. N. E. asks: 1. What is the best battery for silver plating? A. Daniell's constant battery is a good one. 2. How can an old broken graphite crucible be made over into a new one? A. Powder fine, mix with water into a paste, mold, and dry or bake. 3. How can commercial zinc be purified so as to make suitable zincs for a battery? A. Zinc can be purified by distillation. 4. How much pure silver by weight is there in the United States dollar? A. A silver dollar weighs 412½ grains, and contains 900 parts of pure silver in 1,000; therefore $\frac{9}{10}$ of 412½ grains will give the pure silver by weight in a dollar = 371¼ grains. As to your other question, send to D. Van Nostrand for a catalogue.

J. W. B. asks: How can I grind a double convex lens accurately round, with a bevel on each side, to fit any sized frame? It is now done by hand. Can it be done by machine? A. Yes, by an iron wheel fed with sand and water, or a traversing emery wheel. Glass disks are cut out by a rotating vertical metal tube, fed with emery and water.

J. K. says: It is generally considered by scientific men that the sun is a body which emits heat as well as light. Now if the sun is a hot body, why are not the upper strata of the atmosphere heated to a higher degree of temperature than near the surface of the earth? According to the laws of heat, it decreases as the square of the distance increases: and by this law the upper strata of the atmosphere would be warmer than near the earth, which we know is not the case. Again, the annual mean average temperature of the earth in the warmest parts is 90°. The earth is 93,000,000 miles, and Mercury 38,000,000 miles from the sun. The square of the earth's distance is more than six times that of Mercury, nearly 6¾ times, which would make the temperature of Mercury 607·5°. It seems to me that Mercury must be in a state of fusion. I would like to know why it is colder as we ascend above the sea level for a distance of five miles, if the sun is a hot body? Is not the heat which we derive from the sun caused by friction of the rays of light passing through our atmosphere? A. The sun's rays are hotter at great elevations, but they pass through the air without warming it until absorbed and radiated from the surface. The aqueous vapor acts as hot house glass, preventing radiation.

M. J. T.—In reply to the answer given to W. M. W., which was to the effect that the end of the siphon that discharges the liquid should be on a lower level than the end into which it is drawn, M. J. T. says: "I have always supposed that a siphon would draw water to a level with the shortest leg. I don't see that it makes any difference which is the longest, or whether they are both of a length (or on a level). A. M. T. J. is substantially correct. The liquid will run so long as the discharge end of the siphon is below the level of the liquid.

W. R. B. asks: How is danger to the eye by burning prevented in looking at the sun with a powerful telescope? The eyepiece sun glass will not prevent the heat. Is it done by a diaphragm over the object glass, or how? Of what kind of glass is the sun glass made? Could not a large non-achromatic lens be connected by a small over-corrected lens placed near the focus of the large lens? A. A solar eyepiece may be made thus: Attach a short tube, which fits your eyepiece, at right angles to another which fits the eyepiece tube. Place a 1 inch plano-convex lens so that the center of the plane side forms an angle of 45° with the center of either tube. Ten per cent of the solar light and heat will then be reflected up to the eyepiece, and 90 per cent will pass out of the lens. A diaphragm over the objective may be used. Two sun glasses should be used together, a claret and a green one. The sun's image may be received upon a white sheet of paper with the full aperture.

J. M. D. says: 1. We find in Ray's "Astronomy," Chapter V: "If we would use a higher magnifying power, we must find some way to increase the light; in the telescope this is done by enlarging the object glass." In constructing a cheap home made telescope would not a cosmorama lens, 5 inches in diameter and of 72 inches focus, be a higher magnifying power and give more satisfaction for astronomical purposes than an achromatic lens 2 inches in diameter and of 30 inches focus? A. No, unless it were 90 feet focus. It would then bear a power of 190 only. 2. What is spherical aberration? A. Each zone of a spherical lens has a different focal plane, the outer zones having the shortest focus. 3. Is the sewing machine an American or an English invention? A. American. Howe took his first machine to London.

X. X. O. asks: Can you tell me of any combinations of chemicals that will remove the reddish cast of hemlock sole leather and give it the appearance of oak tanning? A. Try a neutral solution of perchloride of iron.

R. H. W. A. asks: 1. Can I use foil from chewing tobacco for coating a Leyden jar? A. Yes. 2. Please me a recipe for a cement for fastening glass to metal. A. Metals may be made to adhere to glass by a cement composed of powdered litharge 2 parts, white lead 1 part, boiled linseed oil 3 parts, mixed with 1 part of copal varnish to a thick paste.

G. E. K. Jr. says: In answer to E. D. E. you say that the earth turns on its axis 365 times in 365 days. I supposed that it only turned 364 times, the solar day being not a revolution of the earth once on its axis, but the return of the sun to a given meridian, which I think is less by about four minutes than a complete revolution (or sidereal day) on account of the onward motion of the earth in its orbit, which would necessarily make one day in a year if the earth did not turn on its axis at all. Am I not right? A. The tropical year, or interval between two successive passages of the sun through the mean vernal equinox, equals 365·24222 mean solar days, or 366·24222 sidereal days.

F. W. B. asks: 1. What chemical reaction takes place between carbolic acid and iodine, when they are mixed in solution? A. Little if any chemical action. The iodine colors the carbolic acid a dark reddish brown color. 2. Is it known whether the action of carbolic acid on iodine would produce such a change in the iodine as would alter the therapeutic action on the system? A. No.

J. H. B. asks: Can a man lift more with a rope over a large pulley than with one over a small pulley? A. In the case of a stiff rope, yes. It is harder to bend a stiff rope over a small pulley than over a large one.

F. A. says: I am told that the coins of the United States for one particular year are at present very scarce and valuable. Will you please tell me what year that is, and also what are the several present values of silver dollars of 1796 and 1799? A. Dollars of 1804, but three known. Dollars of 1794, very scarce. The rest are easily procured at a small premium, if at all rubbed or indented. No dollars were coined from 1805 to 1835. Half dollars of 1804, but one known. Of 1797, very rare. None coined from 1798 to 1800, or in 1816. Quarter dollars of 1823 and 1827, very rare. Coined irregularly until 1831. Dimes: Very rare for the four following years, varied in the order of their rarity: 1804, 1797, 1802, 1808. Coined yearly from 1827. Half dimes of 1802, but three known. Of 1794 and 1803, very scarce. None coined from 1806 to 1828. Three cent pieces of 1855, very scarce. Cents of 1793, 1799, and 1804, very rare. Coined yearly from 1793, except in 1815. Half cents of 1796, rare. Not coined in a regular series. But few of the gold pieces are very rare. The quarter eagle of 1797 is most valuable.

J. P. R. asks: How much power has an engine, 1 inch bore x 3 inches stroke, running at 200 revolutions per minute? How large a boiler should I have, and what kind of metal would be best? A. See article entitled "Indicating Steam Engines," in SCIENTIFIC AMERICAN for January 31, 1874. Allow about 20 square feet of heating surface for a horse power. You can make the boiler of copper or sheet or cast iron, whichever is most convenient.

I. S. S. asks: How thick should a cast lead sphere of 36 inches diameter be to stand a pressure of 25 lbs. to the square inch? How thick one of 30 inches diameter? A. For the sphere, the bursting pressure is equal to the product of the tenacity of the material multiplied by the thickness, and divided by the diameter. For a cylinder, the bursting pressure is equal to the product of the first two terms, divided by the radius of the cylinder. From these rules you can find the necessary thickness.

W. D. G. asks: Why is it that in the block and tackle every additional pulley (the pulleys being all of one size) gives an increase of power? A. It is not true that every additional pulley increases the power, but it tends to increase the space over which the force acts in overcoming a given resistance; so that the same force can overcome more resistance, but requires a longer time. Thus the power developed, which is composed of force or pressure exerted over a distance, remains the same.

X. Y. Z. asks: 1. How can I make a small crucible? A. With fire clay, or a mixture of fire clay and plumbago. Your best plan will be to buy one. 2. What is laminated steel? A. It is a mixture of steel and iron. 3. Is $\frac{\text{diameter}}{180 \times 60}$ = the chord of one minute? A. No.

M. E. asks: Why is it that, after digging a hole in the ground, the dirt will not fill it up as compactly as before? A. It will, if moistened and rammed.

C. E. M. is correct as to the weight of the 40 feet cube of granite. It should have been given at about 5,333 tuns.

G. McK. asks: 1. How can I mend a hydraulic cylinder that has a very fine flaw in it? I cannot see the crack when I have no pressure on it. A. Possibly you can secure a patch with bolts, and braze the joint. 2. What is the best preparation for putting on a rope that has to run on or wrap around a small pulley under water, so as to make the rope last? A. Tar.

J. V. says: 1. We have a boiler of 40 inches diameter, 22 feet long, with two flues of 13 inches diameter. What should be the size of stack to insure the best draft? We have 16 square feet grate surface. Would that be enough to burn sawdust, provided the draft were strong enough? A. Make the area of chimney from ⅛ to 1-10 area of grate. 2. Which saw will cut the easier for both hard and soft wood, the one which is swaged sufficiently for clearance, or one in which the teeth are sprung for set? A. This is a question between rival manufacturers. It can readily be determined by experiment. 3. How can I make the most durable friction wheel, for the feed of a circular saw? A. Probably cast iron will be as suitable as anything.

E. B. L. says: 1. Some of our steamboat chimneys get very hot when running, and others keep quite cool. What are the cause and remedy? A. It is because of improper design in the boilers, or on account of unduly forcing the fires. 2. Is there anything I can put on pine plank to make it fireproof or incombustible? A. There are several varieties of paint that are said to make wood fireproof.

J. B. says: I have some young evergreen trees growing under some walnut trees, but they do not thrive. Can you tell me the reason? A. The reason is that the walnuts shade the evergreens and deprive their roots of proper nourishment. As an antidote, remove the trees where each may have abundance of air, light, and root space.

F. H. H. asks: Why does water form an exception to the law of contraction by cold? What are the principles of its expansion when turning to ice? A. One volume of water at 32° gives 1·102 of ice at the same temperature. There is then an increase of one tenth of the volume in passing from the liquid to the solid condition, the temperature remaining the same. But previously fixing themselves rigidly in certain positions so as to form crystals of ice, the particles of water take up relative positions with regard to one another, in which they occupy a larger volume.

A. T. R. asks: What is the principle on which the Giffard injector works? A. The steam imparts sufficient velocity to the water with which it comes in contact to overcome the resistance offered by the pressure within the boiler.

Z. Z. asks: 1. What is the coloring matter of the leaves of plants? A. The coloring matters of flowers are referred to three distinct substances by certain chemists, one of which is a blue or rose color, while the other two are yellow. The former is produced by a compound which has been termed cyanin. Cyanin may be obtained from the petals of the violet or of the iris. To the yellow matter which is insoluble in water the name of xanthine is given, and to the yellow matter which is soluble, the name of xantheine. See article "Chromatology," *Quarterly Journal of Science*, 1873. 2. Are not the metals of the highest specific gravity the scarcest, and is not this caused by their sinking near the center of earth when the earth was in its molten state? A. The rare metals, which are also noble metals, are of great specific gravity, and many geologists have supposed that this had a close connection with their slight diffusion. But it is a theory difficult of satisfactory demonstration.

J. C. M. asks: 1. How are the salts of nickel and ammonia used for plating? A. See pp. 91, 130, vol. 29. 2. How is wood stained in imitation of ebony? A. Steep the wood for two or three days in lukewarm water, in which a little alum has been dissolved: then put a handful of logwood, cut small, into a pint of water, and boil it down to less than half a pint. If a little indigo is added, the color will be more beautiful. Spread a layer of this liquor quite hot on the wood with a pencil, which will give it a violet color. When it is dry, spread on another layer, dry it again, and give it a third; then boil verdigris at discretion in its own vinegar, and spread a layer of it on the wood; when it is dry, rub it with a brush, and then with oiled chamois skin. 3. What is your price for binding two volumes (in one book) of the SCIENTIFIC AMERICAN? A. Two dollars.

W. T. says (in reply to J. H. P., who says: Astronomers tell us that the earth for ages past has been gradually cooling, but the glacial theory necessitates the belief that the earth was once much colder than it is at present. Has any attempt been made to reconcile the two theories?): Allow me to answer this question. Such an attempt has been made, and, it seems, very successfully, by the celebrated geologist Oscar Von Heer. Astronomers tell us that the sun, with the earth and the other planets, is steadily progressing in space, moving in a very long period around its central body, very probably the star *Alpha Centauri*. It is almost certain that matter is not equally distributed in space, and that there are regions of the heavens where there are more celestial bodies in one given space than another, and consequently these regions are warmer from the heat coming forth from the stars, which all are surrounded by glowing gases, as the spectroscope proves. But in the regions in which they are less abundant, the temperature is colder. O. Von Heer now suggests that formerly, especially during the eocene period, the sun (with the earth) was in a region thronged with stars, and therefore the climate on earth was warmer than it is now; and by gradually progressing to other regions, the climate became colder and colder, until the lowest temperature was reached in the glacial period, and that it moves now to regions that are warmer again. It is my opinion that the earth's heat has not affected its climate since the end of the jurassic period at least, and perhaps very much earlier."

J. L. R. says, in answer to F. O. C. H., who asked how to put a patch on a boiler with bolts so as not to leak: "I put one on a boiler about two months ago, and it does not leak and never will. The patch was 24 bolts long and 4 wide, over where the sheets were riveted. The inside sheet was cracked from one hole to the other for that length. Proceed as follows: Punch or drill your holes and fit the patch to the boiler; make the holes to fit well for ⅝ bolts 1½ inches long, with heads of 1 inch, made solid, and good threads. Put 4 rounds of candle wick with stiff white lead round each bolt and draw it tight. In putting the bolts in, have the heads square with the boiler, and hold them so; be sure not to let them turn. After screwing on the nuts, hammer the heads down hard and screw again, also hammer the patch after it is screwed tight. Caulk the same as a new boiler. It may leak a little before you get up steam; but when you get 30 lbs., and your engine started, it will be tight and will stay so."

M. Y. R. says that P. and G. G. can make a good invisible ink, that will appear upon the application of water, by dissolving powdered alum in the juice of a lemon; the density of the ink is procured by the amount of alum used, but half a teaspoonful to the juice of one lemon is enough.

C. D. S. says to J. H. P., who asks if any attempt has been made to reconcile the glacial theory with the theory that the earth was once in a molten state: The reason assigned by Benton for the change of climate which caused the glacial epoch is that the axis of the earth may not have had the same inclination to the plane of its orbit during the glacial epoch as at present; at the early stage of the earth's existence, volcanic action must have been much more frequent and powerful than at present, and this volcanic action may have caused an upheaval at some point of the surface, accompanied by a corresponding depression at an opposite point, which would be sufficient to alter the center of gravity to such an extent as to change the inclination of the earth's axis to the plane of its orbit. As there is no trace of glacial action within the tropics, some geologists contend that the part of the northern hemisphere on which traces of glacial action are found may have occupied a position analogous to the poles of the earth at present. For a full and satisfactory explanation of this and many other points, read Benton's "Lectures on Geology in America."

S. T. says, in reply to H. C. R., who asks for a plan for an apron for a double ended ferry boat: "The first engine I ever handled was on such a boat on the Ohio river, and the two aprons were hung to the bow and stern decks, much as a barn door is hung, with the difference that the battens were of 5x8 timber and 24 feet long. The apron was 10 feet long. The apron boards were bolted to under side of timbers, and long iron hinges were bolted to apron and deck. This method throws the timbers near each side of the boat, out of the way of teams; and a large clevis on deck, looping over end of timbers, secured the apron up when crossing. On nearing shore, the clevis was dropped off, letting the apron fall on shore. The steering oar had a pin fast in its balance center, and a hole in the outboard of either apron to receive it, so that both ends of the boat could go ahead."

C. S. says that J. H. P. can cure the gapes in his chickens by taking a stiff horsehair, some eight inches long, making a loop of it, putting it down the chicken's throat, and withdrawing it quickly, two or three times, for as many days. This is a sure cure.

F. A. R. says, in reply to P.'s query as to hydrogen: Probably your zinc is too pure; sometimes we are compelled to use very pure zinc and sulphuric acid, and then the hydrogen will come out very slowly, the pure zinc resisting the action of the sulphuric acid. By adding a few drops of chloride of platinum, however, the hydrogen will be produced very quickly, and probably sulphate of copper would be just as well for your purposes as chloride of platinum.

W. S. X. says, in answer to J. H. D., who asks how to reverse an engine: First make a mark on the side of the eccentric, near the shaft, with a scribe or small chisel; make a corresponding mark on the shaft at the same point, then place one point of a pair of callipers on the mark on the shaft, and with the other point find the center of the shaft on the opposite side. Then, with a scribe, mark this point also. Now unscrew the eccentric and move it around in the direction in which the engine is intended to run, until the mark on the eccentric comes into line with the second mark on the shaft; then make the eccentric fast, and the engine will run in the opposite direction. It does not make any difference in what direction the crank is when the eccentric is moved.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

A. M. G.—No. 1 is oxide of iron: No. 2, quartzose rock.

W. N. L.—These two specimens are iron pyrites.

J. W. Z.—No. 1 is clay ironstone; No. 2, sandstone impregnated with oxide of iron; No. 3, the same as No. 2; No. 4, brown ocher, a clay colored with oxide of iron. This might be of service as a pigment.

M. D. W.—This material is shale.

J. P. M.—This is an impure clay.

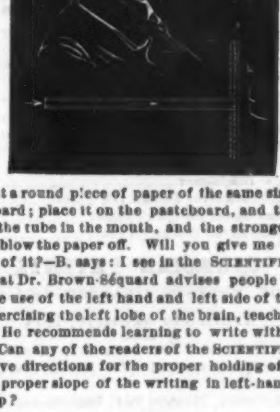
C. J. H.—The specimen sent is limestone. In answer to your other question: We know of no such process, but you can experiment.

G. W. S.—The sample is an impure silicate of alumina.

G. & W.—One of these specimens is a fossil bone, and the other argentiferous galena. The subscription price of this journal is $3 per annum, in all parts of the United States.

W. R. Jr.—Your specimen is an alloy consisting of copper and zinc, in other words, brass. It is possible that a piece of brass may have accidentally fallen into the stamp copper. Native brass has not as yet been found.

M. R. asks: 1. How are sewing machines japanned, what ingredients are used, and how are they applied?—O. S. asks: If 2,000 feet of 6 inch iron pipe is supplied by a pump driven by 24 horse power, will it be any advantage to attach a similar pump, driven by 18 horse power, at the other extremity of the main pipe, in throwing water from a hydrant placed in the center? If so, what?—J. C. C. asks: After being drowned, how long will a person lie under water before he will rise? Is there any difference in the time between fresh and salt water? What is the cause of the rising? If it be gas, what produces it? What is the theory of firing cannons over the water where it is supposed that a person has been drowned?—E. H. K. asks: In the drive wheel of the locomotive engine, where does natural philosophy place the fulcrum, the power and the weight respectively?—E. C. B. asks: What do jewellers use for cleaning diamonds? Is it a solution of arsenic or potash?—J. A. McC. Jr. says: Take a tube, 3-16 inch in diameter, of any length, and cut a round piece of pasteboard 2½ inches in diameter. Make a hole in the center of the board, and insert one end of the tube in the hole:



then cut a round piece of paper of the same size as the pasteboard; place it on the pasteboard, and the other end of the tube in the mouth, and the strongest lungs cannot blow the paper off. Will you give me the philosophy of it?—B. says: I see in the SCIENTIFIC AMERICAN that Dr. Brown-Séquard advises people to cultivate the use of the left hand and left side of the body, thus exercising the left lobe of the brain, teaching it to think. He recommends learning to write with the left hand. Can any of the readers of the SCIENTIFIC AMERICAN give directions for the proper holding of the pen and the proper slope of the writing in left-handed penmanship?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Steam Boiler Explosions. By W. M. D.

On the Attraction of the Sun and the Earth. By A. D., and by A. F.

On a Problem, etc. By G. W. E.

On an Aurora visible in Michigan. By B. B. S.

On Preventing Scale in Boilers. By C. L. E.

On the Beech Blight. By D. E. R.

On the Chameleon. By H. A. H. G.

On the Philosopher's Hunt. By T. H. C.

On a Double Lamb. By J. H. P.

On some Useful Recipes. By C. B. L.

Also enquiries and answers from the following:

T. O'D.—E. P. J.—J. B. S. H.—G. N.—D. F.

Correspondents in different parts of the country ask: Who makes back rests for holding lumber in a lathe? Who sells small brick-making machines? Who sells lath-splitting machines? Who makes artesian well boring machinery? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

April 7, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Life preserver, M. Ormsbee	149,513
Lime kiln, W. S. Sampson	149,415
Lock, permutation, Loch et al.	149,490
Loom, J. D. Cottrell	149,448
Loom for pile fabrics, E. K. Davis	149,294
Loom weft stop mechanism, J. D. Cottrell	149,447
Lumber carrier, E. Tarrant	149,421
Matches, manufacture of safety, L. O. P. Meyer	149,324
Mattress, H. E. Smith	149,350
Measure, board, E. T. Lufkin	149,321
Measure, extension, J. T. Sherwin	149,532
Medical compound, H. W. Epperly	149,455
Mill, pug, G. E. Noyes (r)	5,893
Mill spindle, J. J. Henry	149,475
Millstone dress, K. Schwab	149,346
Molding machine, W. C. Margedant	149,495
Mortising machine, D. L. Gibbs	149,466
Mortising machines, table for, C. Bryant	149,438
Motion, converting, F. H. Richards	149,333
Motor, hydraulic, Monson	149,412
Nose jewel and animal marker, M. Kingman	149,485
Nut lock, Conner & Fuller	149,290
Nut lock, C. R. Watrous	149,362
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Ordnance, breech-loading, W. W. Hubbell	149,478
Organ attachment, reed, H. Q. Staples	149,356
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Organ tremolo motor, A. Hitchcock	149,398
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Padlock, combination, W. F. Rutter	149,528
Pail, milk, L. Frink	149,298
Painter's pail, Landon, Smith & Flood	149,407
Paper, etc., hard sizing, X. Karcheski	149,316
Paper box, G. H. Vickery	149,549
Paper box machine, W. Gates	149,380
Paper, hard sizing, H. Karcheski	149,317
Paper in the web, coloring, X. Karcheski	149,318
Paper machine felt cleaner, Dunn et al.	149,38[illegible]
Paper water-repellent, rendering, X. Karcheski	149,3[illegible]
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Planing machine, W. C. Margedant	149,494
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Plow, H. Jones	149,314
Plow, J. M. Payne	149,515
Plow, F. J. Pettijean	149,518
Plow mold boards, tempering chilled, J. Oliver (r)	5,829
Pot, coffee, D. C. Brown	149,288
Power, hand and foot, J. J. Kimball	149,406
Press, A. Shedlock	149,347
Press, cotton, W. Ruffin	149,342
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Press, hay and cotton, G. Mosteller	149,508
Puddler, mechanical, C. Pernot	149,517
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Reflector, A. Wilhelm	149,555
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Refrigerator, M. H. Hall	149,3[illegible]
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Seeding machine, J. Galloway	149,387
Sewer inlets, grating for, H. W. Clapp	149,378
Sewing machine fan, G. A. & O. Eckert	149,454
Sewing machine, table, and cabinet, H. B. Tracy	149,546
Sheet metal seaming machine, G. H. Perkins	149,516
Shoe lacer, S. Jones	149,315
Shoemaker's burnishing tool, E. T. Ducharme	149,285
Shoe nail extractor, G. W. Hutchins	149,313
Shoe press bed, Winslow & Rogers	149,364
Shovel, fire, J. B. Firth	149,284
Sinks, etc., outlet for, J. Lewis	149,490
Snow plow, J. M. Smith	149,536
Sounding boards, treating, J. H. Bauer	149,426
Speeder for drawing roving, etc., T. Mayor	149,498
Spike machine, N. Tay	149,554
Spring, door, T. C. Houle	149,477
Steamer for potatoes, etc., portable, McDonald et al.	149,411
Stereopticon for dissolving views, S. Belcher	149,286
Stocking supports, clasp for, E. Halsey	149,472
Stone, marbling, R. P. Sause	149,344
Stopper or bung, C. Coblents	149,443
Stove, T. Murphy	149,329
Stove, base burning, J. Q. C. Searle (r)	5,815
Stove, coal, S. H. La Rue	149,487
Stove, grate, T. Searl	149,530
Stove, magazine, cooking, M. T. Fitch	149,458
Stove pipe shelf, H. W. Campbell	149,439
Stove platform, H. L. Palmer	149,514
Stove polish, W. T. Gray	149,302
Sugar, etc., apparatus for drying, C. H. Hersey	149,397
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Table, ironing, H. W. Flint	149,459
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Telegraph sounder, H. C. Royer	149,527
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Ticket box, conductor's, Pritchard & Austin	149,523
Time recorder, watchman's, F. H. Piaget	149,338
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Treadle for machinery, F. Treat	149,360
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Umbrella cases, fixing rings to, J. C. Hurcombe	149,480
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Valve, stop, C. F. Murdock	149,330
Vat, cheese, W. H. Obitts	149,511
Vat, fermenting, A. Langellier	149,408
Vehicle hub, J. E. Harrington	149,394
Vehicle spring, O. Jenness	149,483
Velocipede, F. C. Scharff	149,416
Wagon brake, W. H. Giwits	149,300
Wagon end gate fastening, D. B. Dorsey	149,294
Wall pocket and calendar, C. W. Bryan	149,289
Wall pocket and calendar, J. F. Tapley	149,358
Washing machine, H. Doolittle	149,293
Washstand, portable, M. F. Potter	149,520
Water closet, P. A. Riley	149,339
Wedges, making, Morgan & Foster	149,327
Wheels, mold for casting, J. Everingham	149,383
Windmill, F. M. Goodhue	149,301
Windmill, T. C. McChesney	149,410
Windmill, C. Stewart	149,419
Wire polishing machine, C. Smith	149,531
Yoke, neck, F. J. Deiss	149,450

APPLICATIONS FOR EXTENSION.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

29,085.—Center Board Vessel.—C. E. Ketchum et al. June 24.
29,126.—Revolving Fire Arm.—A. J. Gibson. June 24.
29,200.—Steering Vessels.—F. E. Sickels. July 1.
29,238.—Gridiron.—J. S. Brooks. July 8.
29,409.—Railroad Cattle Car.—J. B. Shafer. July 15.

EXTENSIONS GRANTED.

27,781.—Clothes Wringer.—E. Dickerman.
27,809.—Washing Machine.—J. Johnson.
27,821.—Extension Ladder.—G. B. Mickel et al.
27,832.—Harvester.—L. C. Reese.
27,839.—Street Sweeping Machine.—R. A. Smith.
27,846.—Belting.—H. Underwood.
27,832.—Harvesting Machine.—B. F. Witt.
27,855.—Night Light Protector.—J. Wyberd.
27,860.—Loom.—J. C. Cooke.
27,866.—Cotton Bale Tie.—J. McMurtry.

DISCLAIMERS.

27,781.—Clothes Wringer.—E. Dickerman.
27,832.—Harvester.—L. C. Reese.
27,839.—Street Cleaning Machine.—R. A. Smith.

TRADE MARKS REGISTERED.

1,708.—Bobbins.—J. H. Bullard, Chicopee Falls, Mass.
1,709.—Whisky.—Harthill & Co., Louisville, Ky.
1,710 & 1,711.—Whiskies.—G. W. Kidd & Co., N. Y. city.
1,712.—Canned Oysters.—H. M. Rowe & Co., Balt., Md.
1,713.—Perfumery, etc.—B. F. Ulmer, Savannah, Ga.
1,714.—Fertilizers.—Walton & Co., Wilmington, Del.
1,715.—Stoves.—Western Stove M'f'g Co., St. Louis, Mo.

DESIGNS PATENTED.

7,350 to 7,354.—Center Pieces.—H. Berger, N. Y. city.
7,355.—Lounge Backs.—H. S. Carter, Chicago, Ill.
7,356.—Bird Cage.—G. R. Osborn et al., New York city.
7,357 & 7,358.—Coffin Plates.—W. M. Smith, West Meriden, Conn.
7,359.—Center Piece.—H. Berger, New York city.
7,360.—Arm Holder.—S. H. Cate, Watertown, Mass.
7,361.—Spoon Handles, etc.—J. R. Galaway, N. Y. city.
7,362.—Mail Box Front.—W. Gorman, New Britain, Conn.
7,363.—Center Piece.—S. Kellett, San Francisco, Cal.
7,364.—Dishes.—M. Sweeny, Wheeling, W. Va.

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On application for Design (14 years)	$30

CANADIAN PATENTS.

List of Patents Granted in Canada.

April 8 to April 10, 1874.

3,280.—B. G. Martin, New York city, U. S. Improvements on presses, called "The Martin Press." April 8, 1874.

3,281.—H. Cobley, Toronto, Ont. Improvements on boots and shoes, called "Cobley's Antihydric Boots and Shoes." April 8, 1874.

3,282.—Edward Beanes, Toronto, Ont. Extension of patent No. 341. A process for improvements in brewing, called "Improvements in Brewing." April 10, 1874.

3,283.—D. N. B. Coffin, the Younger, T. H. Johnston, and B. Woodward, Boston, Middlesex county, Mass., U. S. Extension of a provincial patent for improvements in capstans and windlasses. April 8, 1874.

3,284.—A. Pritz, Dayton, Montgomery county, O., U. S. Improvements on car couplings, called "The Pritz Automatic Car Coupling." April 10, 1874.

3,285.—James Inglis, Montreal, P. Q. An article to be used in the process of sensitizing glass or other plates for photographic purposes, called "Inglis' Sensitizing Frame." April 10, 1874.

3,286.—J. A. Tripper and A. R. Giles, Ottawa, Ont. Improvements on a machine for washing clothes, called "The Canadian Washer." April 10, 1874.

3,287.—D. B. Waggener and I. H. Breed, Philadelphia, Philadelphia county, Pa., U. S. Improvement on fire extinguisher, called "The Triumph Fire Extinguisher." April 10, 1874.

3,288.—W. P. Hale, Brockport, Munroe county, N. Y., U. S. Improvements on circular saws, called "Hale's Circular Saw." April 10, 1874.

3,289.—W. P. Hale, Brockport, Munroe county, N. Y., U. S. Improvements on circular gang sawing machines, called "Hale's Circular Gang Sawing Machine." April 10, 1874.

3,290.—I. Newton, Cleveland, Cuyahoga county, O. Improvements on carriage bolts, called "Newton's Improved Carriage Bolt." April 10, 1874.

3,291.—C. H. Thurston, Marlborough, N. H. Useful invention having reference to wooden knobs, closet pins, or handles, called "The Thurston Knob." April 10, 1874.

3,292.—R. Smallwood, Charlottetown, Queen's county, P. E. Island. Improvements on shingle sawing machines, called "Smallwood's Lever Feed for Shingle Sawing Machines." April 10, 1874.

3,293.—T. H. Marsh, Toronto, York county, Ont. Useful agitator to be used in pigeon and bird shooting from the trap, called "Marsh's Agitator." April 10, 1874.

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